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SOFTWARE OBJECT TESTING

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Dear Sir:

AFFIDAVIT UNDER 37 CFR 1.131

1. I, Walter Vahey, am a co-inventor of "Method and System for Software Object Testing" now before the U. S. Patent Office as Application Number 09/482,178.
2. It is my belief that inventorship in the above-identified patent application is correct.

3. Prior to July 30, 1999, I conceived of the invention of "Method and System for Software Object Testing" now before the U. S. Patent Office as Application Number 09/482,178, jointly with the co-inventors named in the above-identified patent application.

4. Prior to July 30, 1999, I jointly, with the co-inventors named in the above-identified patent application, reduced to practice the invention described and claimed in Application Number 09/482,178, now pending in the U.S. Patent Office, as evidenced by the attached presentation entitled "TestMyBeans Business Plan".

5. All of the statements made herein are of my own knowledge and are true, these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application and any patent issuing thereon, or any patent to which this verified statement is applied.

6/25/03
Date of Signature

By: Walter Vahey
Walter Vahey

TestMyBeans Business Plan

Middleware application test business

Revision 2.0

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1.0 Executive Summary

Overview: TestMyBeans.com is an e-commerce software test solution for Enterprise JavaBeans (EJB). EJBs are the leading software component technology, based on the Java specification, used in the development of enterprise web and e-commerce applications. TestMyBeans.com is a web site on which load and functional test can be performed on EJBs. The target customers are EJB developers, QA personnel and systems integrators within enterprise development organizations. These customers upload their EJBs to TestMyBeans.com to perform load and functional testing and pay for the service used rather than acquire conventional software test tools. There are currently no commercial offerings that directly address this need. Our vision is to provide a range of offerings for the enterprise middleware test market as companies invest heavily on rebuilding server applications to achieve the scalability required for the next generation web and e-commerce applications.

Background: The next generation of enterprise middleware will be built using component technology running on Application Servers that automatically manage transaction processing, messaging, and distributed computing, thereby reducing the enterprise application development time while increasing its scalability. For example, using component technology a DirectTV billing system was developed "...in just five months instead of the two to three years it would have taken using traditional programming techniques"¹ The new level of scalability required is illustrated by Home Depot's need: In 1998 Home Depot "...processed about 40 billion internal transactions across 800 central servers and 50,000 other computing devices"² for point of sale, inventory management, web access and call center transactions. In 1999, they are adding new stores at a rate of 12 per month and launching an e-commerce web site. As a result of this growth in enterprise server applications, the middleware software market is projected by IDC to grow "...an astounding 438% from \$2.2 billion in 1998 to \$11.6 billion by 2003."³

We have chosen to initially focus on the testing of EJBs and applications built out of EJBs because we believe this market is currently small (\$3.5M in 1999) but with enough critical mass to achieve rapid growth over the next 3 years. There is an unfulfilled need for an EJB load and functional test product driven by the mission critical nature of the applications and by the time-to-market demands of web applications. We project the software test market for component based enterprise middleware to grow from about \$10M today to about \$100M by 2002 and that EJB technology will account for about 50% of this (\$46M).

Need:

→ IF THIS IS ARE RE-USED, DO YOU NEED FUNCTIONAL TESTING?
Load and functional test of EJBs during Unit and Component Integration Test on the Application Server to validate that the middleware application can handle the expected load prior to integrating the User Interface (UI) and Client software and to verify its functionality.

Opportunity:

We estimate that revenue can grow from about \$3.5M in 2000 to \$25M by 2002 for a CAGR of 167%.

Funding:

This business plan proposes 3 phases.

- Phase 1 funds development of an initial demonstration to validate the product with lead customers. Phase 1 (8/2/99 - 9/15/99) funding is \$75,000 for staffing of 4 and equipment to support the initial demo and sales process.
- Phase 2 (10/1/99 - 2/28/00) funding is \$400,000 for staffing of 5 and equipment to support the initial product release to the initial customers.
- Phase 3 is the ramp-up period to begin 2/28/00 depending upon the success of phases 1 and 2.

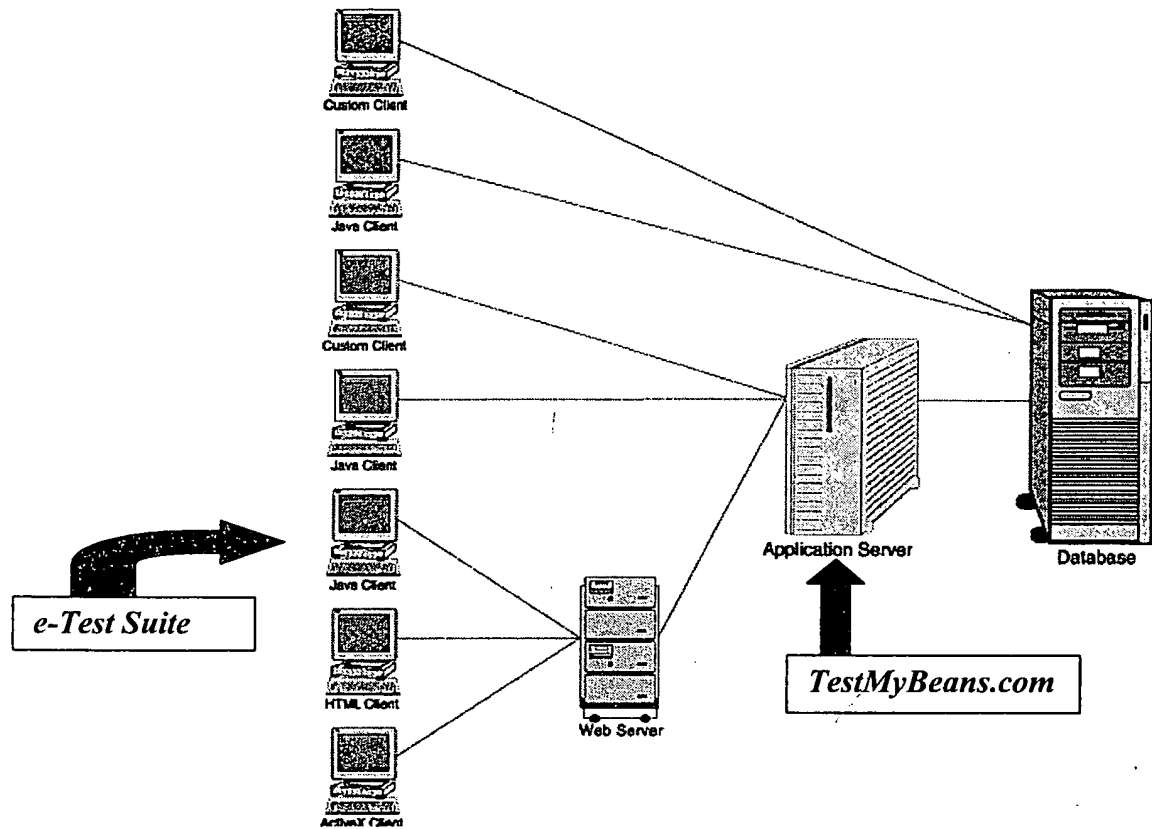


Figure 1: Typical web site architecture illustrates how TestMyBeans.com and e-Test Suite are strategically aligned: e-Test Suite performs system test on the site. TestMyBeans.com tests the software components and integration of components on the Application Server prior to deployment.

The product TestMyBeans.com is strategically aligned with the products RSW offers. RSW's products provide system test of Web Sites through the client browser, in the process testing the web server and to some extent the business logic on the application server. TestMyBeans.com tests the scalability and function of the middleware on the application server (see Figure 1).

1.1 Objectives

1.1.1 Phase 1 Objectives:

- a. Develop a demonstration of Load and Functional Test for use in selling TestMyBeans.com

- b. Validate product idea and business model with 1 EJB supplier and 2 enterprise developers

There are 585 leads from RSW that use the target Application Servers. We have reviewed the product idea with the following sampling. This sampling is the prospect list for Phase 1.

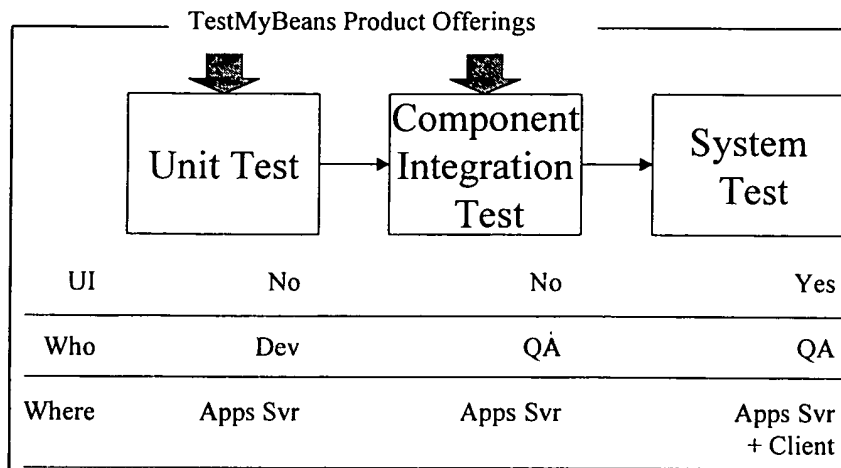
Company	Name	EJB Development?	EJB test need?	Want Demo	Potential Buyer	Current process
Merrill Lynch	Michael Sowa	Y	Y	Y	Y	Develop test harness with servelets. Develop temp UI and drive with Mercury. "accuracy of test is questionable"
USAA	Joe Philipp	Y	N	Referred to QA	Maybe	Develop test harness and temp UI. QA develops test cases for all interfaces between EJBs.
Anderson Consultin	John Bailey	Y	Y	Y	Y	Develop DOS driver. Couldn't test performance early resulting in 4 project iterations after system test.
Theory Center	Mauricio Aguilar Alvarez	Y	Y	Y	Y	Develop driver. No way to test load
IBM	Steve Wolf	Y	?	?	?	?
Home Depot	Mike Anderson	N (planned in '99)	Y	Y	Y	No way identified to perform test. Starting to look at options.
CSC	Beth	N (planned in '99)	Y	Y	Maybe	
Charles Schwabb	Lisa Villarreal	Y	Y	Referral	?	?
NationsBanc	Paula Lash	Y	?	Referral	?	?
Transarc	Bruce Eppinger	Y	Y	Y	Y	No way to load test until system test. Examples of where this has caused problem at customer.
Valtech	David Weil	N/A (EJB training)	Y	Y	Referral	?

1.1.2 Phase 2 Objectives:

- Release initial product offering with Load and Functional test
- Achieve endorsements from 1 EJB supplier, 2 enterprise developers and 1 Application Server
- Achieve 20 company registrations in the first available quarter and \$80,000 in sales.

2.0 Products and Services

2.1 Product and Service Description



TestMyBeans.com offers 2 main products offered to EJB developers and QA: EJB Load Test, EJB Functional Test. In addition to the main products, we will offer a data management product to improve the ease of use. The initial product offering will be offered in with the BEA Weblogic Application Server.

Future products may include: Regression test, container portability or compliance test.

Load and functional test for EJB Unit and Component Integration test. The user establishes a secure link using a customer supplied User Name and Password. Upon establishing the secure link, the user can perform the tests below and manage their data on the site TestMyBeans.com. The web server hosting this product can be either on the Extranet or on the Intranet. Large enterprise customers are expected to need tight control of their source code and want the testing service installed in their own facility. To meet this need, we will either provide the product as a tool to be installed at the customer site or as a web server they would install in their own facility on their Intranet.

2.1.1 Functional Test:

User uploads their EJB, selects the target Application Server, and chooses either to run a default functional test or to supply test data.

If the user chooses to run a default test, the product will automatically test

1. EJB's Data Properties (Get... and Set... methods) for default parameters, boundary conditions (Empty, NULL), and random parameters (Alpha, and Numeric).
2. EJB for methods, exceptions, and data values

The user will receive a report, the default data used, and the Java test script that was automatically generated.

If the user chooses to supply data, the product will

1. Provide an optional data table into which the user can enter the test data
2. Upload the supplied data for execution against the EJB in the Application Server of choice
3. Upload the supplied Java code for script execution

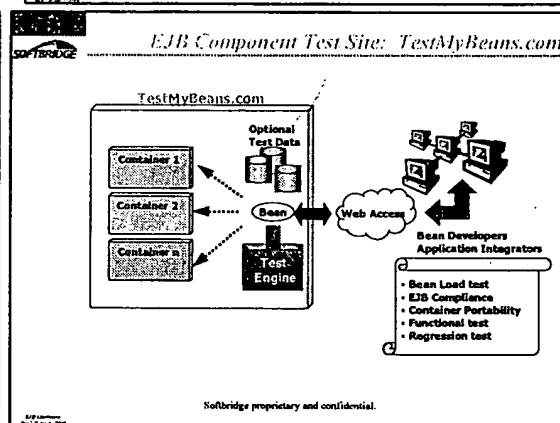
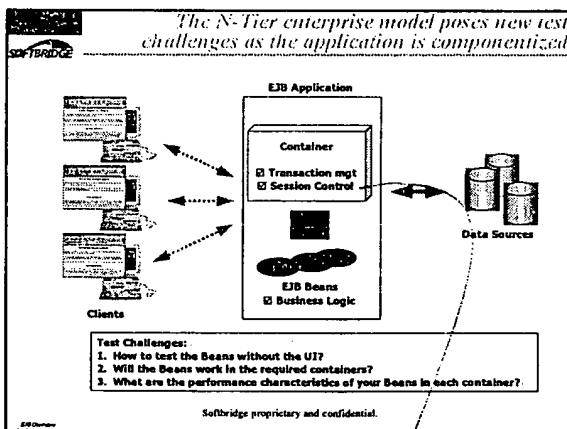
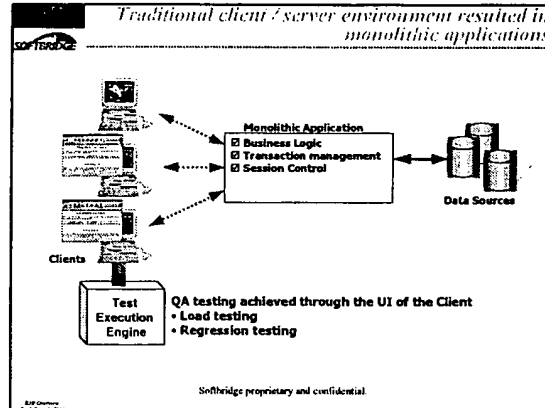
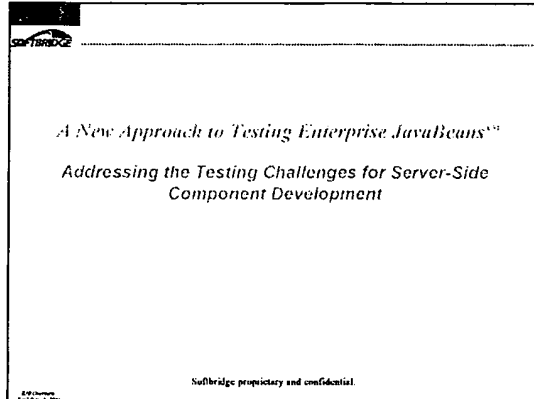
2.1.2 Load Test:

The load test will test the ability of the EJB to handle a user specified number of

1. EJB instantiations to test the scalability of the EJB

2. Virtual clients to test the number of clients with which the EJB can interact
3. Database access and messaging to identify potential bottlenecks

2.3 Sales Presentation



WHAT IS
A CONTAINER?

TestMyBeans.com overview

- **TestMyBeans.com**
 - Test beans individually or in a group
 - Test EJBs in multiple target environments: application servers and containers
 - Manage your data on TestMyBeans.com with a test repository
- **Reduced setup time and cost**
 - No purchase for multiple application servers, EJB containers, and DBMS Systems
 - No installation, set-up, and hardware/software maintenance
- **Transaction-based pricing**
 - Pay only for what you use
 - Pricing based on test performed and EJB size

Softbridge proprietary and confidential.

Tests available on TestMyBeans.com

- **Bean Load test**
 - Create 1 - n virtual clients
 - Default or customer supplied test data
 - Use multiple application servers and containers to identify performance characteristics unique to each server/container
- **EJB Compliance test**
 - EJBHome interface
 - EJBRemote interface
 - Exceptions and Methods specific to SessionBean or EntityBean interfaces

Softbridge proprietary and confidential.

Tests available on TestMyBeans.com

- **Container Portability test**
 - Regression test run in multiple containers
 - Load test run in multiple containers
- **Functional test**
 - Exercising methods through public interface for issues like Exception Handling, Boundary Conditions, Parameter Verifications, Syntactic Validation
 - Tuning the environment for the target EJB Container
- **Regression test**
 - Default or customer supplied test data
 - Alternative containers and environments

Softbridge proprietary and confidential.

Test data and management services on TestMyBeans.com

- **Test data repository: Each user can set up a private data repository for**
 - Test scenario creation
 - Baseline comparisons
 - State transition analysis, etc.
- **Graphical interface to your bean's interface**
 - Automatic generation of excel-like table exposing the bean's public interface for easy data input
 - Automatically generated drivers that exercise bean with test data

Softbridge proprietary and confidential.

2.3 Technology

2.3.1 Technological Assumptions

There are 2 technical assumptions underlying this plan:

1. Rapid growth of the underlying Application Server market
2. EJB will be a leading technology for enterprise applications requiring a high degree of scalability (large web sites, e-banking, e-commerce, e-financial services). The competing technology is Microsoft COM+ scheduled for introduction in 2001.

2.3.2 Patents

There are 2 patents applicable to this plan:

1. Use of a web site as a test harness for an application under test

Problem Statement: WEB applications often combine objects and services from many sources to create an application. Similarly, organizations that deploy distributed, object technology-based systems deploy these objects across multiple systems (servers) across the organization. Requirements for testing these applications often require having them installed locally (local client &/or server) due to limitations of either the test environment, performance, or limitations of the test tools, thereby not testing accurately or adequately the true software & its environment(s).

Invention:

WEB based test harness to facilitate:

- Remote object testing
- Remote object, server and container validation
- Load testing on remote servers
- Manage/control tests in a distributed environment
- Automatically generate tests (scripts / data) from/for remote objects

2. Creation of a data table from the EJB .jar file that makes data entry easy for the application under test

Problem Statement: The challenge to the component developer is: how do I test my components without having to write an application to exercise the component?? The requirement to write such an application to test components blurs the lines between Software Development and Software Quality Assurance functions and organizations, and may even result in components being improperly or incompletely tested before being used in a live environment by "stretching" the capabilities of either group.

Invention:

Software Object Test Harness provides Software Object developers / testers a facility in which they can load their object(s), expose the public interface, and employ an easy-to-use, non-technical user interface to manipulate the interface elements, exercise functions, and evaluate results. The tool is simple enough to use to be used by non-technical SQA personnel (i.e.: business analysts) to test components. The tool would also provide a facility to automatically format test data input forms (based on what it "learns" from the object, and provide a facility to entry of multiple test cases and run them en masse.

2.3.3 Technology trends

The client server architecture is being replaced with an n-Tier enterprise architecture. The Client part of the Client/Server architecture was replaced with the web browser and enterprises invested heavily in supporting browser clients by building Web Server applications that either ran entirely on this web server or that interfaced to the legacy server which provided the business logic. The next trend we are predicting is a strong investment in the Application Server part of the architecture as existing web server applications need to scale larger and as legacy servers are replaced to support scaling the application.

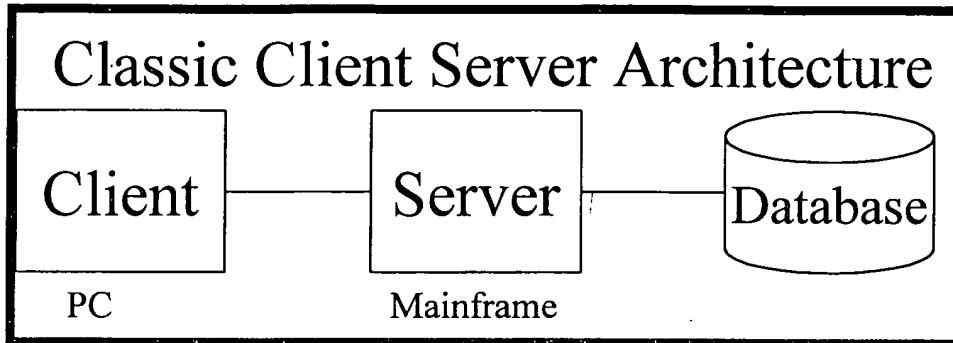
Evidence of this is the rapid growth of enterprise Application Servers such as BEA Weblogic, Netscape and IBM Websphere.

The following is reprinted from InformationWeek 9/28/98:

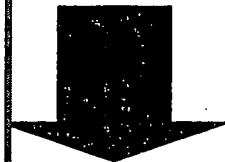
" In the deal, valued at more than \$192.5 million, BEA will give 7.7 million shares for WebLogic, a 94-person, privately held company that makes a Java-based Internet application server. BEA calls the acquisition its most important strategic move since it bought its flagship Tuxedo transaction server from Novell in 1995. It says the purchase will let it connect its transaction middleware with electronic commerce and intranet applications. ...Analysts concur: the acquisition of WebLogic is a real coup for BEA"

About the same time, Sun purchased NetDynamics Application Server for \$180M and Netscape purchased Kiva Application Server for about \$180M.

IS THIS SERVER H/W OR S/W?



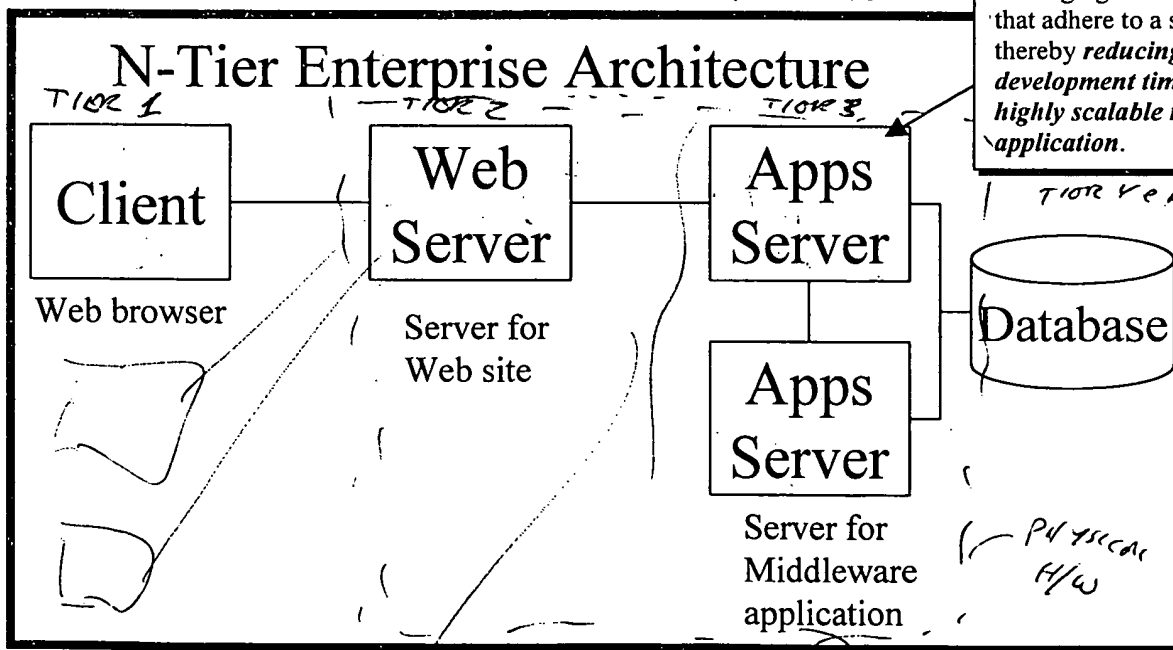
Enterprise computing architecture is evolving to N-Tier model, providing for highly scalable applications in support of the internet



IS PRO-PACKAGED S/W THAT DOES THESE STUFFS.

INTERFACE BETWEEN BOTH + DATABASE LIKE AN OPERATING SYSTEM.

The Apps Servers (eg Weblogic) automatically manage transaction processing, distributed computing, and messaging for middleware applications that adhere to a standard (eg. EJB), thereby *reducing application development time and producing a highly scalable middleware application.*



TIER 4

PHYSICAL H/W

NEED A NEW INSTANCE OF APPLICATION FOR EACH CLIENT CONNECTED.

APPS SERVER IS PART OF THE SERVER

USERS SERVER - PROBABLY THE SAME AS AN APPLICATION OR FRONT APPLICATIONS

3.0 Market Analysis Summary

3.1 Market Segmentation

	1998	1999	2000	2001	2002
Number of EJB Seats	26,656	88,973	328,184	713,659	1,033,921
EJB Test TAM	\$ 1,066,260	\$ 3,558,912	\$ 13,127,363	\$ 32,114,676	\$ 46,526,441
TestMyBeans.com Revenue	\$ 0	\$ 80,000	\$ 3,500,000	\$ 15,000,000	\$ 25,000,000
EJB Test Share	0%	2%	27%	47%	54%
Software Test Share	0%	0%	0.6%	1.8%	2.0%
Total Software Test Market from 1/99 Schedule 1	\$ 286,000,000	\$ 409,000,000	\$ 584,870,000	\$ 848,061,500	\$ 1,229,689,175

3.2 Target Market Segment Strategy

1. Win EJB suppliers to as lead customers. The top 3 EJB suppliers are IBM, Theory Center, EC Cubed. Forge relationships with these suppliers such that they refer their customers to TestMyBeans.com.
2. Initially focus on enterprise developers using BEA WebLogic Application Server. Weblogic has the lead market share position (estimate at 40%) with key customers such as Amazon.com. We will have intimate knowledge of Weblogic and as such provide the best service and product ease of use.

3.3 Main Competitors and their positioning

There are 3 classes of competitors for this product:

1. Broad based tools suppliers (eg. Mercury, Segue, Rational)
2. Application Server providers (eg. BEA, Oracle, IBM, Netscape)
3. Niche tool suppliers (eg Parasoft)
4. Web based test service (eg. KeyLabs).

There is currently no supplier of EJB test tools. The alternatives EJB developers currently have are

1. Mercury and Segue offer traditional web test tools that test the EJB as part of an overall Enterprise Web system from the client browser User Interface. Mercury's offerings in this area are WinRunner, LoadRunner and TestDirector.
2. Segue's offerings in this area are SilkTest, and SilkPerformer.
3. Parasoft offers jtest!.

4. KeyLabs offers testing for 100% Java certification.

3.3.1 Mercury Interactive positioning:

WinRunner and XRunner simplify test automation by approaching the task from a business-process perspective. While a user accesses the Java application, these tools automatically translate user actions into clear, readable test scripts, which can be later replayed to verify the functionality of the later builds of the application

3.3.2 Segue Positioning:

SilkTest recognizes the multiple technologies that are found in e-business applications, whether they are client/server or browser based, including Java applets or components, HTML, images, ActiveX, Visual Basic, and C++.

3.3.3 Rational Positioning:

how does TB fit? →
Rational Suite TestStudio is a complete solution that makes functional testing both simpler and more effective. Functional testing must ensure that applications meet business requirements. Rational Suite TestStudio helps you accomplish this with two market-leading tools. Rational Robot™ is the industry-leading tool for creating and maintaining functional test scripts. And the award-winning Rational Requisite®Pro manages requirements and test plans that trace test results and testing progress across the team and throughout the project lifecycle.

TestStudio is included in the product RationalSuite with the following positioning:

Rational Suite is a unique product family that elevates software development to a higher level. Rational is the first company to deliver an integrated solution for the entire software team. Rational Suite will:

UNIFY

Rational Suite will unify your analysts, developers, and testing professionals by breaking down the barriers that normally sit between cross-functional teams.

OPTIMIZE

Rational Suite is optimized for the individual by delivering the right set of market-leading tools for each member of your team.

SIMPLIFY

Rational Suite simplifies your software development environment, and lowers your total cost of ownership.

Additionally, Rational poses a risk in their teaming with Microsoft:

strategic alliance announced today, the companies' relationship now spans a number of new areas, including tighter integration of products, joint development and marketing, cross-licensing of technology and training materials, continued embedding of Rational's visual modeling technology into Microsoft Visual Studio, and broad internal use of Rational Suite Enterprise, Rational Suite PerformanceStudio™ and Rational ClearCase® by Microsoft's software development teams.

3.3.4 Parasoft Positioning

Class-level testing

Performing a full array of tests on each of your classes as soon as they are compiled is an essential step in guaranteeing that code is robust and error free at the class level. Testing at the class level is integral to application quality for two main reasons:

1. It allows developers to find and prevent errors early, when they are easier and less costly to fix, and before they spawn more errors.
2. It is the most effective way to achieve full structural coverage

White-Box Testing

White-box testing checks that a class is structurally sound. It does not test that a class behaves according to specification; instead, it ensures that a class does not crash and that it behaves correctly when passed unexpected input.

Black-Box Testing

Black-box testing checks that a class behaves according to specification; that is, it checks that the class produces the correct output (outcomes) for each input. Inputs are generally derived not by examining the code's structure (as they are in white-box testing), but rather by looking at the specification that defines what the code is intended to do.

Regression Testing

Performing precise regression testing is another necessary step in guaranteeing software quality and reliability. Regression testing-- testing modified code under the exact same set of inputs and test parameters used to test that code previously-- is the only way to ensure that modifications did not introduce errors into the class, or to check if modifications successfully eliminated errors.

Static Analysis

Static analysis analyzes source code to uncover violations of coding standards. As a few select software companies that produce mission-critical software which human lives depend on already know, enforcing coding standards is the key to reducing errors in software development.

- How DOES THIS DIFFER FROM WHITE BOX TESTING

3.3.5 Keylabs Positioning

Keylabs provides Benchmarking, Certification, and Performance testing. The testing is performed at their lab by Keylabs staff. Examples of these services are

KeyLabs' Benchmarks

NICBench™ (Network Interface Performance Benchmark)

FireBench™ (Firewall Performance Benchmark)

FrameBench™ (Citrix WinFrame Server Performance Benchmark)

WebBlaster

SQLLoad

Examples of certification programs are 100% pure Java, Novell Yes, Solaris Ready, Linux Tested,

3.4 Competitive Summary

	Test Harness	Price	TestPlan	Positioning
Mercury Interactive	GUI	\$50,000	Yes	System test
Segue	GUI	\$50,000	Yes	System test
Rational	GUI	\$50,000	Yes	System test
Parasoft	?	\$5,000	No	Unit test for Java (not EJB)
KeyLabs	API	\$5,000	No	JavaCertification
TestMyBeans.com	API	\$100/test	Yes	Component test

3.5 How to establish and maintain competitive advantage

Proposed approach for achieving competitive advantage against:

1. Broad based tools suppliers (eg. Mercury, Segue, Rational)
 - a. Transaction based pricing vs tool acquisition pricing. The tools suppliers are unlikely to change their pricing model this drastically because they have such infrastructure around their existing model.
 - b. Optimize our technology for performing Object test instead of GUI test. The tools suppliers have built their technology around tools for testing GUIs that are installed at the customer site. Examples of how we've optimized our technology for Object test are (1) creation of a data table from the EJB description

- * per one of our patent applications, (2) tight integration with the Application Servers like BEA and (3) creation of automatic test sequence using default and boundary condition data.
- c. Optimize delivery for web site application instead of tool installation. The tools suppliers have built infrastructure around the delivery and support of a tool. We will optimize our delivery and support to be web based. For example, we will provide a data repository and revision control that can be accessed by various members of the same team providing for more collaborative work. *WHAT OF THE OPTIMIZATIONS*
- d. Optimize our offering for operation in the target Application Servers (BEA, Oracle, IBM, Netscape) so that we provide the best service and best
- 2. Application Server providers (eg. BEA, Oracle, IBM, Netscape)
 - a. Optimize our offering for Functional and Load test rather than simply validating that the EJB could theoretically operate in a given container.
 - b. Market to the Application Server providers for us to become the independent labs for test and certification.
- 3. Web based test service (eg. KeyLabs)
 - a. Optimize our offering for Functional and Load test rather than simply validating or certifying that the EJB theoretically complies with the Java specification.
 - b. Market to the Application Server providers for us to become the independent labs for test and certification.

4.0 Strategy and Implementation Summary

Our target customers are developers at large corporations who are deploying business-critical server applications based on BEA Weblogic, Netscape, IBM WebSphere, and Oracle Application Servers. Major verticals include: financial institutions, e-commerce retailers, and Web portals.

Our business is to help our customers ensure the scalability and quality of their business-critical enterprise applications.

Our strategy is to provide a web-based testing solution for targeted Apps Servers that is easier to learn, easier to use, and easier to buy than our competition. We will focus on component load testing on the targeted Apps Servers.

We will differentiate through a combination of:

1. **Product leadership** with easy to use products that are designed to test components and integration of components without a User Interface that are run on our targeted Apps Servers.
2. **Customer intimacy** with an organization that specializes in component testing and understands the subtleties of the targeted Apps Servers and the intricacies of component load testing.
3. **Sales process** that is designed to engage qualified customers as quickly as possible while maintaining the lowest sales costs in our industry.

4.1 Logic Chains

Feature	Advantage	Benefit
Application Service Provider) ASP based availability	No tool installation, management or support required	Lower tool overhead costs (assuming 1 installation /yr) (20 hours installation + 1 hours / week support * 50 weeks) * \$100 / hour = \$7,000 avg annually per tool Reduced time: 20 + 50 hours = 70 hours
		Reduced support costs Load: 15% maintenance * \$40,000 = \$6,000 annually Functional: 15% maintenance * \$10,000 = \$1,500 annually

		<p>Reduced time-to-results</p> <p>Assume</p> <ul style="list-style-type: none"> • installation / configuration takes 10 hours per tool x 2 tools = 20 hours • 5 persons use the tools at a location: 100 hours
		<p>Reduced hardware acquisition costs:</p> <p>Assume 2 dedicated servers average: \$50,000</p>
Functional Test	No need to write and support their own test harness	<p>Lower cost:</p> <p>Anderson data:</p> <p>1 day for initial driver; 2 hours per method, 20 methods tested (out of up to 1,000 methods).</p> <p>1 day + 2 hours x 20 = 48 hours = 1 week.</p> <p>Average 20 - 40 EJBs per application: 1 week x 30 = 30 weeks to perform test by hand.</p> <p>30 weeks x \$100 / hour = \$120,000</p>
		<p>Reduced time to market:</p> <p>30 weeks savings from above</p> <p>This understates the savings because multiple iterations of the application are typically required because the problems are found late in the cycle at System Test.</p> <p>(1,200 hours)</p>
Load Test	Provide system requirements different from the currently configured on the customer's site.	<p>Reduced cost:</p> <p>Alternative is to build test environment from hardware or build a UI on the EJB and test with Loadrunner.</p> <p>Total cost: \$50K hardware+\$25K software+5K Application server+10K networking cost= \$90,000</p>
	No need to build a harness and create an ad-hoc application to drive the EJB to simulate the load	<p>Reduced time</p> <p>Anderson data: 2 - 4 weeks for small integration of EJBs with questionable results. Assume 3 weeks x 5 "small integration of EJBs" per year = 15 weeks. (600 hours)</p> <p>Reduced cost</p> <p>600 hours x \$100/hr = \$60,000</p>
	Reduce the problems found at system test where they can't be corrected until the next release	<p>Reduced time</p> <p>Anderson data: 4 revisions required to achieve desired load performance using only system test. Assume reduction of 1 revision and each revision takes 12 weeks. (480 hours)</p> <p>Reduced cost</p> <p>480 hours x \$100/hr = \$48,000</p>

4.2 Value Proposition

Reduced Time	Alternative
ASP based	100
Functional Test	1200
Load Test	1080
Total hours saved	2380

Reduced Cost	Alternative
ASP based	\$ 57,500
Functional Test	\$ 120,000
Load Test	\$ 198,000
Total savings	\$ 375,500

4.4 Marketing Strategy

The marketing and sales strategy would be modeled after RSW's model. Marketing would concentrate on establishing relationships with the target application server companies (eg BEA for Weblogic) and generating leads to their customers. The sales model would be telesales using web access of the product to give qualified prospects an easy way to try the product while an applications engineer helps them get started over the phone.

4.4.1 Target markets and customers

There are 2 target markets: EJB suppliers and Enterprise developers. The primary market is the enterprise market. We would target the EJB suppliers to provide leads and references to their customers (the enterprise market).

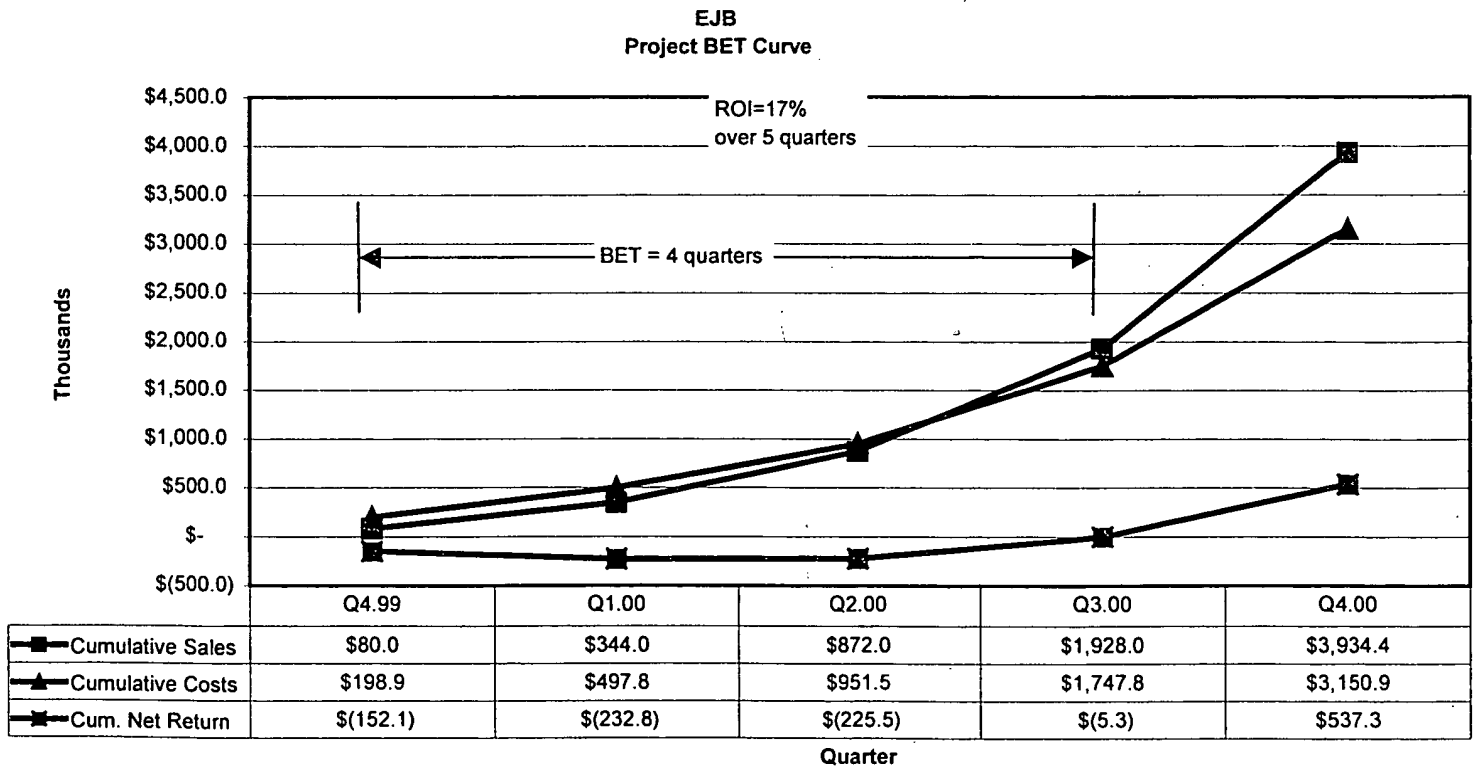
Target Market	Example customers	Buyer	Role
EJB Supplier	Theory Center	EJB developer	Member of team who develops and tests EJBs for resale to Enterprise Developers
	EC Cubed	EJB developer	Member of team who develops and tests EJBs for resale to Enterprise Developers
	IBM (San Francisco Project)	EJB developer	Member of team who develops and tests EJBs for resale to Enterprise Developers
Enterprise Developer / Integrator	CSC	EJB developer and QA	Member of team who develops and integrates EJBs for use in Enterprise System deployment
	Home Depot	EJB developer and QA	Member of team who develops and integrates EJBs for use in Enterprise System deployment

4.4.2 Pricing Strategy

Test	Per Transaction	Small Enterprise	Typical Enterprise	Large Enterprise	EJB supplier
Load test (per virtual user)	\$0.10	\$ 16,406	\$ 21,488	\$ 29,672	\$ 23,738
Functional test (per test run)	\$20.00	\$ 7,500	\$ 9,000	\$ 11,250	\$ 18,000
		\$ 25,781	\$ 32,738	\$ 43,734	\$ 46,238
Typical Monthly Revenue per EJB development team at each target customer type		\$ 2,148.44	\$ 2,728.13	\$ 3,644.53	\$ 3,853.13
Annulized Revenue		\$ 25,781.25	\$ 32,737.50	\$ 43,734.38	\$ 46,237.50

5.0 Financial Plan

5.1 Breakeven Analysis



5.2 Projected Profit and Loss

Revenue Summary	Q4.99	%	Q1.00	%	Q2.00	%	Q3.00	%	Q4.00	%
# of Customers	20		40		60		120		228	
Revenue	\$ 80.00		\$ 240.00		\$ 480.00		\$ 960.00		\$ 1,824.00	
(ASP/Customer/Qty)	\$6K / \$8K									
Revenue by Test Type:										
Functional	\$ 48.00		\$ 144.00		\$ 240.00		\$ 384.00		\$ 729.60	
Load	\$ 32.00		\$ 96.00		\$ 240.00		\$ 480.00		\$ 912.00	
Regression	\$ -		\$ -		\$ -		\$ 96.00		\$ 182.40	
Services			\$ 24.00		\$ 48.00		\$ 96.00		\$ 182.40	
Net Sales	\$ 80.00	100.0%	\$ 264.00	100.0%	\$ 528.00	100.0%	\$ 1,056.00	100.0%	\$ 2,006.40	100.0%
G&A	\$ 49.67	62.1%	\$ 55.95	21.2%	\$ 68.85	13.0%	\$ 79.41	7.5%	\$ 113.67	5.7%
Engineering	\$ 110.79	138.5%	\$ 113.29	42.9%	\$ 117.04	22.2%	\$ 163.70	15.5%	\$ 205.75	10.3%
Services	\$ 0.00	0.0%	\$ 14.60	5.5%	\$ 25.70	4.9%	\$ 26.81	2.5%	\$ 38.46	1.9%
MKTG / Sales	\$ 38.40	48.0%	\$ 115.16	43.6%	\$ 242.07	45.8%	\$ 526.38	49.8%	\$ 1,045.19	52.1%
Total EJB Project costs	\$ 198.85	248.6%	\$ 298.99	113.3%	\$ 453.66	85.9%	\$ 796.30	75.4%	\$ 1,403.08	69.9%
Summary P&L	Q4.99		Q1.00		Q2.00		Q3.00		Q4.00	
Net Sales	\$ 80.0		\$ 264.0		\$ 528.0		\$ 1,056.0		\$ 2,006.4	
Contribution (Margin 100%)	\$ 80.0		\$ 264.0		\$ 528.0		\$ 1,056.0		\$ 2,006.4	
Total EJB Project costs	\$ 198.9		\$ 299.0		\$ 453.7		\$ 796.3		\$ 1,403.1	
Profit	\$ (118.9)		\$ (35.0)		\$ 74.3		\$ 259.7		\$ 603.3	
	-149%		-13%		14%		25%		30%	
Capital Cost	\$ 35.0		\$ 50.0		\$ 75.0		\$ 50.0		\$ 75.0	
Net Return	\$ (152.1)		\$ (80.7)		\$ 7.3		\$ 220.2		\$ 542.6	

Phase 2 - Phase 3 Projected Project Cost Summary

Est EJB Project Costs	Q4.99	Q1.00	Q2.00	Q3.00	Q4.00
Staffing Costs:					
Est GM / Admin Costs	42.48	42.48	49.17	49.17	62.55
Est Eng Costs	97.79	97.79	97.79	138.20	172.75
Est Services Costs	-	9.23	18.45	19.56	29.34
Est Mkting/Sales Costs	-	14.91	103.63	219.69	376.15
MKTG: Advert/PR/Collateral	38.40	98.37	116.69	263.19	594.80
Travel (GM, Mktg, Serv., Sales)	2.50	7.00	17.50	28.00	43.75
Operations: pc's, supplies, etc (\$600/staff/Q)	2.55	3.15	5.10	7.50	11.10
Facilities rent / deprec / tele *	13.39	16.54	26.78	39.38	58.28
(Rate/staff/Q: \$1.55K / \$.85K / \$.75K)					
Corp G&A Alloc	-	5.28	10.56	21.12	40.13
EJB Project Costs: Additional Deprec/Qtr.	1.75	4.25	8.00	10.50	14.25
Total EJB Project Cost	198.85	298.99	453.66	796.30	1,403.08
EJB Capital Costs:	Q4.99	Q1.00	Q2.00	Q3.00	Q4.00
(Impacts cash flow but deprec.)					
Hardware	10	25	50	50	25
Software:					
Weblogic	25				25
IBM		25			25
Netscape			25		
EJB Capital Costs	35	50	75	50	75
Additional Deprec. / Qtr. for current Qtr add	1.75	2.50	3.75	2.50	3.75
Cumulative Depreciation Additions / Qtr.	1.75	4.25	8.00	10.50	14.25
EJB staffing	Q4.99	Q1.00	Q2.00	Q3.00	Q4.00
GM	1	1	1	1	1
Mktg	-	0.5	1	2	2
Serv	-	0.5	1	1	1.50
Engin	3	3	3	4	5.00
Admin	0.25	0.25	0.50	0.50	1
Sales	-	-	2	4	8
Total EJB Staffing	4.25	5.25	8.50	12.50	18.50

6.0 Backgrounders

EJB Flashpoint from InformationWeek May 3, 1999

Business developers are realizing cost and productivity benefits from this maturing Java component technology

By Martin Marshall

The developers and early adopters of Enterprise JavaBeans hope that this emerging technology is reaching a cultural flashpoint in the application development arena. EJBs are the newest outgrowth of the Java development movement.

Enterprise JavaBeans are components that let applications communicate across multitier client and server environments, and across Internet and intranet structures. It may well be that Java and Enterprise JavaBeans together constitute the most fundamental architectural change in software development for at least the next five years.

Zona Research Inc. has just concluded a study of the business benefits of Enterprise JavaBeans, as well as a series of in-depth interviews with early adopters of EJBs at large companies. The conditions necessary to drive EJB adoption, according to those surveyed, include the maturity of Java into a stable platform, and the emergence last summer of a number of Web application servers that support the EJB 1.0 specification.

EJB 1.0 defines the interfaces and general behavior of Enterprise JavaBeans components, including session beans that contain business-process models and entity beans that can act as persistent data containers on the network.

To say that Enterprise JavaBean technology has reached the cultural flashpoint is premature. The technology still lacks the standardization of the entity-bean implementation that will be part of the EJB 1.2 and 2.0 specifications now in the works. The EJB 1.2 and 2.0 specifications don't overturn the EJB 1.0 specs, but add more information on how the entity beans are implemented.

The committee on EJB standardization, which includes most of the active vendors of EJB-supporting Web application servers, is finalizing how much of the implementations will be published as part of the EJB 1.2 spec expected out this quarter, and how much will be left to the EJB 2.0 specification that's expected by year's end. In part because of that, the standard lacks a large community of third-party EJBs that will enable developers to snap applications together without building any beans.

EJBs For Real Business

The business benefits of Enterprise JavaBeans are many. They include rapid time-to-market development of complex Web applications. EJBs also separate an application's business logic from the underlying technical implementations of that logic performed by the EJB containers. The implementation logic, such as how a component will actually roll back a two-phase commit in a financial transaction, can be part of the container of an Enterprise JavaBean. The business logic, such as whether or not one decides to initiate the transaction in the first place, is carried in the business logic that a developer adds as the "contents" of the container.

To the IT manager, this translates into having the ability to assign different people to different tasks that match their skills, and to model the application around recognizable objects of functionality that resemble their corresponding physical-world business processes. This, in turn, translates into a greater degree of manageability of an overall project, and the greater possibility of reusing components in future projects.

For example, the container of an Enterprise JavaBean may be created to roll back transactions within a specific IT infrastructure. When the next application is created, the same container may be reused with different front-end business logic. This is particularly important in the financial community, where different financial instruments are created simply by changing the front-end business logic.

The key business driver behind the adoption of Enterprise JavaBeans is the time it takes to roll out a new product or service and supporting applications. Technical drivers include programmer productivity and code manageability.

Why would big companies care about these technical details? They're mostly focused on competition, market opportunity, and the Internet. A recent Zona Research survey showed that 85% of companies polled either have or are planning to deploy Internet or intranet applications within 24 months. Three years ago, only 15% had such plans.

But particularly in the financial services field, competition has often become a race to create and modify new software. New financial instruments mean new products, and today that's synonymous with a new application. The ability to modify a program quickly so that it works differently and presents a new financial instrument is becoming crucial.

Developers turn to Java because it has easy facilities for establishing Internet and intranet session connections, and because they found they were spending too much time debugging memory-pointer errors in C++. Java has been made far more useful by the appearance of JavaBeans two years ago, and by the appearance of Enterprise JavaBeans within the past year.

JavaBeans are components of functionality that reside on a single system. Enterprise JavaBeans come into play when you need distributed objects to communicate across either the client-server barrier or the server-server barrier.

Enterprise JavaBeans can also act as wrappers for other types of objects, including Microsoft's Component Object Model components and the Object Management Group's Corba objects. In this way, integrated applications using existing COM or Corba components can be used in an Enterprise JavaBeans distributed application. The wrapping of these components into Enterprise JavaBeans is done automatically in various Java development environments.

The container feature of the Enterprise JavaBean is what separates the business logic from the underlying implementations. This is what enables the project-development manager to separate the people doing the business-logic programming from the people doing the back-end implementation of things like transaction processing.

Once the container exists, for example, underlying transactions can be handled by an external transaction-processing monitor. Security can be handled by an external security manager. Cache management, messaging management, and access to external data through Java Database Connectivity can all be handled separately by the container. With a bit of luck, the IT manager can even buy the containers with most of the back-end implementations ready for customization.

All of these services can be handled by EJB servers, freeing the writer of the business logic from having to know anything at all about how to handle security, or how to maintain cache coherency. The latter is a function that makes sure the temporary, fast storage of data is in sync with the main body of data, even if other users and other applications are changing the data.

Concentration On Logic

EJB containers let business-logic specialists concentrate on business logic, making the container itself responsible for security, transaction management, persistence of data, and life-cycle management of the object itself. From the point of view of the business-logic programmer, implementation of the business logic becomes an automated process. He or she can, for example, specify the data to be accessed without having to worry about how that data is actually brought into the application.

All of this can sound complex unless you know what programmers had to do previously to make serious, network-aware applications work. When they had involved transactions, programmers had to write the rollback routines from scratch, or at least know the interfaces to complex transactional systems such as CICS and Tuxedo.

These functions are now contained in the Enterprise JavaBeans class libraries that come with some of the Web application servers. By year's end, they'll be available as separately sold commodities by third-party vendors such as Active Software.

With EJB containers, business logic takes on a more recognizable face. Units of work can be defined in terms that

make sense to non-programmers, because they reflect the workflow of the physical business processes that the program is modeling. This even allows the use of high-level modeling programs such as Rational Software Corp.'s Rational Rose, which, among other choices, now has the ability to output object models into EJB code.

Those who have adopted Enterprise JavaBeans in their IT architecture are finding complex applications take less time to develop than non-Java applications, and complex projects are being completed on time.

A major European financial institution estimates that its trading application, which took six months to create using EJBs, would have taken more than twice as long to bring to market if the developers had used traditional programming environments.

A major package-delivery company created a workflow application to track aircraft-engine documentation and maintenance. In so doing, it calculated that three lines of EJB code would be needed in a part of the application that would have required 3,000 lines of traditional code. Programmers also estimated that the potential to reuse objects could eventually yield up to 50 times more functionality.

A major Wall Street firm transaction-enabled a large trading bulletin board in two months, using four programmers, at a cost of about \$200,000. According to the firm's estimates, the same effort using Corba would have taken two years to accomplish and cost \$2 million.

Qwest Communications Corp. in Denver created a customer-retention system in three months using Enterprise JavaBeans. The telecommunications company calculated that it would have taken six months to build the system using C++.

The Federal Aviation Administration estimates that the EJB container it used as a general user interface layer saved as much as half of the programming time needed for a project to create a set of order-processing applications.

The manageability of code and the reduction of the scarce skills problem were often lumped together by the IT managers in the Zona Research study as key benefits of Enterprise JavaBeans. The technology also helps IT managers deal with "feature creep," a factor that all IT departments must deal with when users ask for increasing functionality during the development of the application. Enterprise JavaBeans has made it easier to handle these mounting user requests. Because application logic is broken down into smaller parts, features can be added in smaller batches and revised more frequently. This reduces (though doesn't eliminate) the political battles that are fought over which department's features are incorporated into a given release of an application.

The skills shortage is particularly acute with IT managers implementing transaction-enabled applications. Because the containers of the Enterprise JavaBeans can implement the transactions or farm them out to an external transaction-processing monitor, the IT managers could have their programmers concentrate on writing the business logic of the application, rather than on constantly tracking the transaction and rollback processes.

Among the more significant real-world implementations of applications using Enterprise JavaBeans are those in the telecommunications, financial services, and transportation industries.

Covad Communications Corp., a large Internet service provider in Santa Clara, Calif., that specializes in broadband Internet communications for businesses, needed a number of telecom operations support systems, including a customer-care system, an order-status system, a performance-monitoring system, and an online-backup system. After first considering Microsoft's COM model, development manager Vinu Sunaresan decided to do them all using Enterprise JavaBeans.

"We knew we needed a component model, but we were very nervous about the scalability of Windows NT," he says. Covad chose to go with Oracle on Solaris, using Java to address the application scalability issue. The company opted for BEA Systems Inc.'s WebLogic Tengah application servers.

Ease Of Change

Rapid application development and quick time to market were important criteria in the choice of EJBs, but perhaps even more so was the facility to change the application very quickly every three months or so. "We started off

thinking about using the Corba model, but we calculated that it would have cost us three to four times the time to create them as opposed to using Enterprise JavaBeans and Java," Sunaresan says.

Sunaresan was able to save himself a good deal of time by buying third-party JavaBeans and containers. These included Nightfire, Vitria's business-process automation technology, Inprise's JBuilder library, and a set of generic JavaBeans from the Kael Group.

Telecom company Qwest is well-known for building, buying, and leasing hundreds of miles of fiber-optic cable to provide high-bandwidth service to businesses. As director of sales-force systems, David Sayre's task was to create a customer-retention system to handle all of Qwest's billing, trouble-ticket processing, order-servicing, and order life-cycle processing. That system, done using Enterprise JavaBeans technology, is already in production. Sayre is using EJBs on a project to offer a wide range of customer self-service systems.

For Sayre, the paybacks are multiple. In terms of time to market, he calculates that it would have taken his team six to eight months using C++ to create the customer-retention system; it took them three months to create it in Java. "It's the cleanest way to manage your server code, and stats show that Java decreases the number of bugs you experience in development testing, especially in the area of memory management," Sayre says.

Another dimension to the project is the formality of the Enterprise JavaBeans methodology, which lends itself to a greater degree of reusability in the subsequent application. "The stuff integrating the back office to the Enterprise JavaBeans container is reusable," Sayre says.

As an example of mapping real-world logic onto programming logic, Sayre's group created an Enterprise JavaBean that modeled the hierarchy of sales personnel. "It abstracts the business groups, such as the national accounts, in a way that we can easily change," he says.

SCT Corp. is a producer of enterprise resource planning software, including supply-chain management, and planning and scheduling optimization. Its Adage, FYGIR Planning, and FYGIR Scheduling software competes in the process supply-chain management arena with ERP software from Baan, J.D. Edwards, Oracle, PeopleSoft, and SAP.

SCT uses the GemStone/J Web application server, embedded object-oriented database, and business-object development environment. Bob Marsilio, general manager of component development for SCT, says the next generation of Adage and other SCT products will be built around Enterprise JavaBeans.

The current "Brazil" release of the GemStone/J environment used by SCT has its own business objects called Stones and Distributed JavaBeans. Marsilio says SCT hasn't yet produced Enterprise JavaBeans, but has developed using the distributed JavaBeans in GemStone. These will be converted to Enterprise JavaBeans shortly.

Java and Enterprise JavaBeans constitute a fundamental architectural shift in software development. There isn't a single piece of functionality that can be created with Java and Enterprise JavaBeans that couldn't be created with C or C++. The difference is that the functionality can be created considerably more quickly--and with far fewer worries about the memory leakage and pointer allocation errors that make C/C++ programmers toil away.

While these factors are attractive and show that serious, large-scale commercial applications can be built using Java and Enterprise JavaBeans, it's also generally acknowledged that both Java and EJBs need improvement in some areas. These include the need to standardize EJB entity bean implementations; the speeding up of client-side Java execution by up to a factor of 10; and the extension of Java to capabilities such as the direct manipulation of devices like modems and disk drives.

Moving forward, there will likely be widespread adoption of EJB technology as deployed applications move along the experience curve to the point where top management will feel comfortable committing increasing development resources to Java.

Martin Marshall is a director at Zona Research. He can be reached at mmarshall@zonaresearch.com.

SUN SOON COULD have its vindication. Java, often dismissed as too unwieldy to displace traditional programming languages, is fast emerging as a key tool for building new software applications that streamline business management and power Internet commerce. That poses a problem for Microsoft, which has staked its biggest hopes for growth on dominating those markets with its Windows NT operating system and related applications.

"Java has come very far, much further in a shorter amount of time than anyone could expect," says Larry Perlstein, an analyst with Dataquest Inc. "The credit for that really has to go to Sun."

Consider that Sun's big Java trade show in June, drew 21,000 attendees, a 50% increase from last year. By the end of June, nearly one million software developers had registered as members of the Java Developer Connection, an online forum for Java programmers, up from 790,000 in January.

Java has a long way to go before it is anywhere close to being what Sun Chairman Scott McNealy calls "the written and spoken language of network computing." So far, it has failed to endanger Microsoft's lock on personal-computer software, and while Sun has struck a number of deals intended to make Java programs a standard for new Internet-enabled cellular phones, TV set-top boxes and other gadgets, that effort is still embryonic.

Microsoft, in fact, scoffs that Sun again is promising more than Java can deliver. "Java on the [PC] client generated significant hype and momentum, but failed to deliver on its promise," says Tod Nielsen, a Microsoft vice president for development. Now, he says, Java's latest iteration "is starting to run into the same mistaken expectations."

Still, achieving a foothold in corporate computing is an important milestone for Java, which Sun hopes can thwart Microsoft's drive to dominate corporate servers, or central computers, as thoroughly as it does PC desktops. Embrace of the technology by corporate information officers demonstrates that many developers find Java useful, if not indispensable, for building the complicated applications that run modern business. A few, in fact, even argue that Java - and not competing technologies from Microsoft - has already become the de facto standard for new business-software development.

"My guys are in love with the stuff," says Ron Griffin, chief information officer at Home Depot Inc., which now uses Java almost exclusively for new software development. "It gives us a lot more flexibility."

Programs written in Java typically can run on any number of types and brands of computers without major modifications. That's a threat to Microsoft, which has thrived by fostering the development of programs that only run on computers that use Microsoft's operating systems. Java's ability to run on a variety of machines not only breaks that "application lock," but also makes it far easier for companies to develop new software that can be used anywhere across far-flung data networks.

Home Depot, for instance, last year processed about 40 billion internal computer transactions across 800 central servers and more than 50,000 other computing devices throughout the company. By using Java to write new applications, such as one that manages the huge flow of data from

Home Depot's telephone call centers, Mr. Griffin's team has a much easier time managing software across those machines.

Java is getting another significant boost from the rise of so-called application servers, which are used to host database-analysis applications, Internet-based e-mail and calendars, and electronic commerce. The makers of such application servers increasingly rely on Java to perform complex calculations on data that reside on incompatible computers.

The latest evolution of Java, a new technology known as Enterprise JavaBeans, or EJB, is where Java's promise has truly started to take hold. EJB allows programmers to write large programs in reusable chunks, or "beans," that can be swapped out, updated, and recombined to form new programs. Such component-based programming suddenly makes it possible to develop, test and maintain much more complicated programs - which may be distributed across hundreds or thousands of servers - more quickly than ever before.

EJB is "the advent of the second industrial revolution of computing," says William Coleman III, founder and chairman of BEA Systems Inc., a major developer of application-server software. The first, he says, was Microsoft's Windows, which made it possible to develop standard programs for virtually the entire PC world.

Last year, for instance, BEA was able to use EJB to build a new billing system for DirecTV, a unit of General Motors Corp.'s Hughes Electronics Corp., in just five months instead of the two to three years it would have taken to write using traditional programming techniques, Mr. Coleman says. Even better, BEA was later able to reuse some of that same software to develop another billing system for a separate customer in just 21 days.

Brokerage firm Charles Schwab & Co. has just completed a fixed-income trading system using EJB as a trial project. "Enterprise JavaBeans is definitely a strategic direction for us," says Lisa Villarreal, a Schwab vice president. "It's given us the ability to launch new products and new channels very quickly."

Microsoft is promoting a rival technology it calls the distributed component object model, or DCOM, which also helps programmers write modular software. DCOM, however, has one big weakness - it only runs on Microsoft's Windows NT, which remains far less reliable than other corporate operating systems such as Unix. Schwab, for instance, worried that it couldn't use DCOM for larger transactions and didn't even consider it as a way of developing new applications.

Java, however, faces further trials. Microsoft continues to press forward with new versions of Windows and its component software model, and could threaten to fragment Java itself. In May, a federal judge tentatively ruled that Microsoft is free to develop and market its own version of Java so long as it doesn't use Sun's intellectual property, a step that could destroy Java's universality. Microsoft hasn't said whether it will do this, although the company has dropped broad hints that such a move could be in the works.

Sun's Java allies insist that even Microsoft can't splinter their alliance. Says Pat Suetz, general manager of Java at International Business Machines Corp., "Java is bigger than any one company - it's bigger than Sun, Microsoft, Oracle or IBM."

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Worldwide Revenues in the Middleware/Businessware Software Market Will Jump 438% from 1998 to 2003

Businessware Management Systems Lead the Growth Spurt

Growth in the worldwide middleware/businessware (real-time EAI) market is on the fast track. Revenues will increase an astounding 438% from \$2.2 billion in 1998 to \$11.6 billion by 2003. This data comes from International Data Corporation's (IDC's) report *Middleware and Businessware: 1999 Worldwide Markets and Trends*.

"Just about everyone acknowledges the essential role that middleware plays in today's world of increasingly distributed systems," said Ed Acly, director of IDC's System Infrastructure Software: Middleware and Businessware. "It is becoming less likely today that a distributed application program will be built without the use of middleware in one form or another. The choice for the most part is no longer whether customers will use middleware for a distributed application program, but rather whether the middleware used will come in the form of an independent product or technology embedded in another category of products."

According to IDC, throughout 2003, customer demand for middleware technology will shift among market segments. Therefore, the growth rate of the overall market and of each segment are both important indicators of the overall market's potential. IDC believes the fastest-growing segment will be businessware management systems, which will earn a compound annual growth rate (CAGR) of 76.5% from 1998 to 2003, which compares with a 40% CAGR for the entire market. The growth of the businessware management system occurred in 1998 as a result of customer need for a better way to deliver application integration. From 1999 to 2003, IDC expects event-driven processing and business process automation will increasingly kick in to drive the expected growth.

In 1998, middleware and businessware use was highest on the Unix operating environment, which earned \$884.1 million, accounting for 41% of the total market's revenues. "Unix's numbers are interesting because they indicate the platform is not losing out to NT," Acly said.

U.S. vendors dominated the overall market, capturing 74% of its 1998 revenues. The region also consumed almost 49% of middleware and businessware software. Western Europe was the next-largest spender, accounting for more than 32% of revenues.

EJB vs MTS Analysis from Patricia Seybold Group

Microsoft defined the first server component model when it released Microsoft Transaction Server (MTS) in December 1996. Since then, a number of application server vendors have copied Microsoft's ease-of-use, automatic services architecture, including Sybase, IBM, and BEA. But no individual vendor has really proffered a viable contender until Sun defined the Enterprise JavaBeans (EJB) component model in March 1998. Since then, 18 different Java application server vendors have released EJB-compliant products. MTS and EJB are alike in a lot of ways. This report compares and contrast the two most popular server component models.

Comparing EJB and MTS

Server Component Models

By Anne Thomas

February 16, 1999

NETTING IT OUT

Microsoft Transaction Server (MTS) and Enterprise JavaBeans (EJB) are fighting for dominance in the server component arena. A server component model defines a standard interface between a server component and an application server. Application servers have become a keystone of the modern IT infrastructure. If you haven't picked one yet, you will need to soon.

MTS comes bundled with NT Server. It's tightly integrated with the NT environment. It supports every conceivable programming language for clients and servers. But you can only get it from Microsoft, and it only runs on NT.

EJB is rapidly gaining popularity. At this writing, 18 vendors provide EJB-compatible application servers. EJB servers run on every conceivable platform. But you can only develop applications in Java.

MTS is a mature product – it's more than three years old – and it's popular for in-house development projects. But for some reason it hasn't been adopted by the third party application vendors. EJB is very young – less than a year old – but it has a huge following. A number of third party application components are already shipping.

Server-Based Computing

The Internet has had a tremendous impact on application architectures. Although client/server isn't completely dead, it is no longer at the forefront of application development trends. These days everyone is getting into server-based computing.

Server-based computing is very different from client/server. In client/server, the majority of the application logic runs as an application on a desktop client machine (generally a Windows variant), and the database server runs on a remote machine. In server-based computing, the majority of the application logic runs in an application server, which may or may not reside on the same machine as the database server. The application server can support a variety of thin client interfaces, such as Windows applications, browsers, PDAs, robots, or any Internet-connected application.

Strategic Decision

The application server has become one of the most critical infrastructure services within the corporate information architecture. Your choice of application server is as strategic today as your choice of database server was in the 1980s.

Application servers come in a variety of styles, each specializing in its own set of features. Any environment that supports the execution of server-side applications is calling itself an application server. The oldest application servers were originally known as TP monitors, including IBM CICS, IBM TXSeries, and BEA Tuxedo. The more modern application servers, such as IBM WebSphere, BEA M3, Netscape Application Server, and Microsoft Transaction Server, now support object-oriented programming principles, and many include a built-in HTTP server. Oracle now provides an application server within the Oracle8i database.

(A Distributed Computing Monitor feature article from June 1998, entitled "Java Application Servers, Evaluation Criteria" provides an evaluation framework for analyzing product offerings. The article focuses primarily on Java-oriented products, but most of the evaluation criteria apply to application servers that support any language.)

Server Component Models

Until recently, each application server used a proprietary set of application programming interfaces. An application

that was designed to run in CICS couldn't run in TXSeries, much less run in M3 or Netscape Application Server. But a number of standards are emerging in the application server space. An application server standard is called a server component model. Just as SQL and ODBC defined a standard programming interface to allow an application to talk to any relational database, a server component model defines a standard programming interface to allow a server application component to talk with its application server in a standard fashion. In addition to establishing standards, a component model provides a framework that simplifies application development and enables component reusability.

Attribute-Based Computing

Microsoft deserves full credit for defining the first server component model. In 1996, with the release of Microsoft Transaction Server (MTS), Microsoft defined the first server environment to truly support application assembly. MTS allows developers to take a collection of server components, wire them together, and create an application system. In many cases, the developer doesn't need to write any new code.

Microsoft also invented the first server environment to support *attribute-based programming*. Development components such as ActiveX controls and JavaBeans allow developers to customize snippets of application code (components) through a set of attributes defined as properties. Properties live outside of the application code, but they affect the behavior of the component. A developer can change these properties, which causes the behavior of the component to change; therefore the developer can customize the application without actually changing the application code.

MTS uses properties to define a component's transactional behavior. The MTS runtime framework automatically manages transactions on behalf of the component based on the values specified in the transaction attribute. In every previous transactional environment, developers had to write transaction demarcation code within the application. For a centralized application, transaction demarcation is relatively straightforward: start the transaction at the beginning of the task, commit it at the end of the task, and rollback in case of an error.

But component-based applications consist of a variable number of autonomous application components that invoke methods on each other. Keeping track of all the constituents in a distributed transaction can get very complicated. Since MTS automates all transaction control, the developer doesn't need to be concerned about when a component is supposed to start a new transaction or enroll in an existing transaction, or determine whether all pieces of the transaction completed successfully.

Attribute-based programming is also the secret to reusability. Since the transaction attribute is

specified at application assembly time, rather than at development time, there is no code within the component that determines how transactions are supposed to behave. A component can behave one way in one application and another way in another application without changing any code.

Interception

Attribute-based computing is accomplished using a process called *interception*. An application server provides a runtime framework, called a container, that implement services on behalf of the application components. When an application is installed in the application server, the installer specifies the transaction attributes associated with each component in the application. At runtime, the container intercepts each method call invoked on the component, and based on the value specified in the transaction attribute, automatically starts a transaction or enrolls the object in an existing transaction. Once the container has completed its management tasks, it delegates the request to the object. When the object completes the method call, the container automatically commits the transaction if there were no errors or rolls back the transaction if there were errors.

Comparing Component Models

There are three dominant server component models on the horizon.

- **Microsoft Transaction Server.** Microsoft uses a proprietary server component model based on COM for the MTS application server. With the release of Windows 2000, this component model will be renamed COM+. (*See DCM June 1997 for a review of MTS and DCM November 1998 for a review of COM+.*)
- **Enterprise JavaBeans.** Sun Microsystems' Java Software Group, working with input from many application server vendors, defined a standard server component model for Java called Enterprise JavaBeans (EJB). More than a dozen Java application server vendors support the EJB model, including BEA, Bluestone, GemStone, IBM, Information Builders, Inprise, Netscape, Novera, Oracle, OrchidSoft, Persistence, Progress, ProSyst, Secant, Sun/NetDynamics, Sybase, Valto, and Visient. (*See DCM February 1999 for a review of EJB.*)
- **CORBA Components.** The Object Management Group (OMG) is in the process of defining a server component model based on

CORBA. OMG is using the EJB model as a starting point, and complete interoperability with EJB is a primary goal. Most CORBA vendors, including BEA, IBM, Inprise, and IONA, have endorsed CORBA Components.

The CORBA Component model is still in development, so it is difficult to make a reasonable assessment at this time. According to the latest specifications, it appears to be a language-independent variant of the EJB model. The remainder of this article compares the MTS component model to the EJB component model.

Implementation versus Specification

To some degree, it is inappropriate to compare MTS to EJB. MTS is an implementation of Microsoft's COM server component model. EJB is a specification of a model. It would probably be more appropriate to compare MTS to a vendor implementation of EJB, such as BEA WebLogic. But one of the key advantages of EJB is its vendor-independence. Each vendor implementation offers its own unique set of features. Customers can select the vendor implementation that best suits their needs. Therefore this article attempts to compare the MTS model to the EJB model. Any comparisons related to implementation issues are stated as such.

Evaluation Criteria

Both EJB and MTS rely on a similar architecture. Both systems support attributed-based computing. Both systems provide a runtime container that automates the use of certain system services such as transactions. The most obvious differences are in vendor-independence, platform-independence, and language-independence, which we collectively call *platform factors*. EJB and MTS provide a slightly different set of *automatic services*. There are also a number of subtle differences related to the models' simplicity and flexibility, which we call *versatility factors*. And perhaps the strongest testament to a component model is its *industry acceptance*.

Platform Factors

- **Vendor Options.** MTS is available from only one vendor: Microsoft. EJB implementations are currently available from 18 different vendors.
- **Cross-Vendor Portability.** MTS components can run only in MTS. EJB components can run in any EJB-compliant application server (although some tweaking may be required).

- **Platform Support.** MTS only runs on Windows NT. It is included in the standard Windows NT Server distribution kit. EJB platform support is an implementation issue. Each vendor supports a specific set of platforms. EJB implementations are available for just about every platform that supports Java, including Windows 9x, NT, OS/400, OS/390, and many flavors of Unix.
- **Language Support.** MTS is a language-independent component model. MTS server components can be developed using Java, C++, C, Visual Basic, Delphi, PowerBuilder, or practically any other development language. EJB is a language-dependent component model. EJB server components can only be developed in Java.
- **Development and Administrative Tools.** MTS components can be developed using most COM-compliant development tools. No special tools are required to build MTS components, although many development tools provide wizards to automate the development of MTS components. MTS provides a set of administrative tools to deploy and manage MTS applications. EJB components can be developed using any Java development environment. Most Java IDE tools now provide wizards to automate the development of EJB components. Each EJB implementation supplies its own set of administrative tools to deploy and manage EJB applications.
- **Protocol Support.** Clients access MTS using COM, which runs over the Microsoft RPC protocol. Clients access a EJB server using Java RMI, which runs over the JRMP or IIOP protocols, or using CORBA, which runs over the IIOP protocol.
- **Client Support.** MTS supports any client that supports COM, including ActiveX clients on Win32, WinCE, Internet Explorer, and IIS Active Server Pages. EJB supports Java clients on any platform (including embedded devices) through RMI, CORBA clients on any platform through IIOP, and Web clients through Servlets or Java Server Pages. Many EJB implementations provide Web server plug-ins to

support Web clients through NSAPI, ISAPI, and CGI Web server extensions. Some EJB server implementations provide support for ActiveX clients.

- **Database Support.** MTS requires database drivers that support OLE Transactions. Most major relational databases support OLE Transactions. EJB database support is an implementation issue. From an architectural point of view, EJB can access any data source, including relational, object/relational, and object databases, flat files, and live data feeds. Most EJB implementations use JDBC to access relational databases. Some implementations provide access to one or more object databases. Many implementations support access to flat files and live data feeds.
- **Integration Support.** Microsoft provides an integration development tool for MTS called COM Transaction Integrator (COM TI). COM TI generates MTS components that provide connectivity to OS/390-based CICS or IMS applications. COM TI is packaged as part of SNA Server. EJB integration support is an implementation issue. From an architectural point of view, EJB can access any external application environment. Some EJB implementations provide packaged connectors or application adapters for CICS, IMS, MQSeries, SAP R/3, PeopleSoft, or other third party application systems. Most EJB implementations provide some type of integration framework to allow customers to develop custom application adapters.

Automatic Services

Multi-User Support. Both MTS and EJB provide automatic services to manage multi-user support. Developers build server components without worrying about multithreading or concurrency control.

Transactions. Both MTS and EJB provide automatic transaction services, although EJB supports a slightly simpler interface, and it provides an override mechanism. In both cases, transaction semantics can be defined for each method in the object. In MTS, developers only need to use two

transactional commands in each component. If all work has been successfully completed, the component calls the SetComplete method to notify the container that all is well. If an error occurs, the component calls the SetAbort method to notify the container that the transaction must be rolled back. MTS supports four possible transaction attributes:

- **Not Supported.** The method does not support transactions.
- **Supported.** The method can support a transaction, but it doesn't require one.
- **Required.** The method requires a transaction. If the caller doesn't provide one, the container will create one.
- **Requires New.** The method always requires a new transaction, even if the caller provides one.

EJB completely automates transaction control. A developer does not need to use any transactional commands. The container determines the success or failure of the transaction based on exceptions. If the method doesn't throw an exception, then the container assumes that all is well, and it commits the transaction. If the method throws an exception, the container assumes that the transaction failed, and it rolls back the transaction. An object can force a rollback by calling the SetRollbackOnly method. EJB also allows an object to bypass the automatic transaction service and control its own transactions. EJB supports six possible transaction attributes:

- **TX_NOT_SUPPORTED.** The method does not support transactions.
- **TX_SUPPORTS.** The method can support a transaction, but it doesn't require one.
- **TX_REQUIRED.** The method requires a transaction. If the caller doesn't provide one, the container will create one.
- **TX_REQUIRES_NEW.** The method always requires a new transaction, even if the caller provides one.
- **TX_MANDATORY.** The method requires that the caller provide a transaction.
- **TX_BEAN_MANAGED.** The bean manages its own transactions, specifying its own transaction demarcation.

Security. Both MTS and EJB support automatic access control security services. MTS relies on NT security services for user authentication. Based on

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the user identity, the MTS container allows or denies access to a specific object method. EJB relies on Java security services for authentication. Based on the user identity, the EJB container allows or denies access to a specific object method. The sophistication of the EJB security service is a vendor implementation issue.

State Management. Both MTS and EJB support automatic object state management, although EJB offers significantly more versatility. MTS generally assumes that components run as stateless servers. In other words, the component does not maintain any user-dependent state across method calls. MTS ties state management to transaction management. The MTS container automatically purges any active state associated with the object instance when it completes or aborts a transaction. The next time the client invokes a method on the object, it gets a newly activated instance of the object. If the component needs to save its active state across method calls, it has two options. Either it can leave its transaction uncompleted (don't call SetComplete or SetAbort), or it can manually save the object data in a database or in the Shared Property Manager (SPM). When the next method is called, the object must manually restore its state before it can get back to work. EJB supports three different types of objects: stateless objects, stateful objects, and persistent objects. State management is not tied to transaction management. State management behavior is defined using a separate set of attributes.

- **Stateless.** Stateless objects act like MTS components. Each time a method completes, the EJB container purges the active state, and each new method call gets a newly activated instance.
- **Stateful.** For stateful objects, the EJB container automatically saves the object state across method calls for the lifetime of the object instance. Each time a user invokes a method on the object, it gets the same instance with the same data it had the last time it was called. No code is required within the object to save the state.
- **Persistent.** A persistent object is an in-memory representation of data that reside in a database. Any changes made to the persistent object must be propagated to the database.

Persistence. EJB supports automatic persistence. MTS does not. When developing a persistent EJB

component (called an *entity* bean), a developer can write code to manually read and write the object data to and from the database, or the developer can let the EJB container automatically manage persistence on behalf of the object. The deployer uses attributes to indicate which fields in the object must be persisted. If the EJB container manages persistence, then the object is portable across any data store. For example, the object could be mapped to Oracle in one application, to DB2 in another application, and to GemStone in another application.

The data stores supported for automatic persistence is an implementation issue, and the sophistication of container-managed persistence varies among vendor implementations. Support for entity beans and container-managed persistence is not required by the EJB specification. Most vendors support entity beans, although Sun/NetDynamics, Oracle, and Novera do not. GemStone uses the GemStone object database for automatic persistence. Most other vendors support persistence in a relational database using some form of object/relational mapping. Persistence and Secant provide extremely sophisticated object/relational mapping services.

Versatility Factors

Simplicity. Microsoft's primary goal for MTS is to make server-based computing as easy as client/server computing. MTS automates a number of tricky system services, and it provides developers very few options to override the automatic services. MTS automatically handles multithreading, concurrency control, security, transactions, and state management.

Simplicity is also a goal for EJB, although perhaps not to the same degree as for MTS. EJB automates the same tricky system services (multithreading, concurrency control, security, transactions, and state management), but it provides numerous hooks that allow the developer to override the automatic services. EJB supports different types of state management. EJB also automates persistence.

Flexibility. EJB allows developers to override any EJB automatic service, including transactions, security, state management, and persistence. MTS does not.

Industry Acceptance

MTS. MTS is a mature product. It was first released in December 1996. Since it is distributed as part of NT Server, a huge number of companies have access

to it. It is moderately popular as a platform for in-house application development. It has not managed to attract very many third party application vendors, though. We have been able to find four third party applications built on MTS.

- Catalyst (<http://www.catalystwms.com>) is in the process of porting their successful Unix-based warehouse management system (Catalyst WMS) to NT. The new system will use MTS.
- Infinium Software (<http://www.infinium.com>) provides financial and human resources applications (Infinium Financials and Infinium Human Resources).
- SilkNet Software (<http://www.silknet.com>) provides a customer-focused call center and problem tracking application suite called eService.
- Webridge (<http://www.webridge.com>) provides an extranet application suite (Mainspan) to help customers rapidly implement Internet-based sales channels.

EJB. EJB is a very young technology. The specification was published in March 1998, and the first products shipped in August 1998. The application server vendors have resoundingly endorsed the model. What's more, it seems to be popular among the third party application vendors. We continually hear of more application vendors adopting EJB.

- Athena Design (<http://www.athena.com>) provides Integer, a collaborative spreadsheet component.
- Digital Harbor (<http://www.digitalharbor.com>) provides Workspace NG, a portable, thin-client Java desktop environment that uses the EJB architecture to access host-based application systems.
- EC Cubed (<http://www.eccubed.com>) provides ecWorks, a suite of customizable application components for electronic commerce.
- IBM (<http://www.ibm.com>) is converting the San Francisco business object framework into EJB components.

- Novasoft Systems (<http://www.novasoft.com>) provides an electronic document management and integrated workflow system called Novation.
- Oracle (<http://www.oracle.com>) is converting the Oracle applications to support EJB.
- TRADE'ex (<http://www.tradeex.com>) provides a business-to-business electronic commerce application component suite, including Procurement and Distributor.

Microsoft Contentions

Microsoft has posted a white paper on its Web site (see <http://www.microsoft.com/com>) entitled "Comparing Microsoft Transaction Server to Enterprise JavaBeans". The paper is mostly accurate, although it is quite biased. In the paper Microsoft made a number of contentions which are fodder for debate.

- Microsoft contends that the extra options in EJB makes the environment more difficult to understand. We concur that the EJB learning curve might be slightly steeper than MTS, but most sophisticated applications will require these options. Once a developer understands the concepts, EJB's extended services make the environment easier to work with. We can't help but point out that EJB automates more services (stateful and persistent objects) and requires less code.
- Microsoft contends that EJB will never support true component portability. Microsoft points out that the EJB specification was formed by a committee, and that there is no reference implementation; therefore it is doomed to fail. But Sun is currently addressing these issues. A compatibility test suite and a reference implementation is scheduled to be available later this year.
- Microsoft contends that there will be interoperability problems between different vendors' EJB implementations. For one thing, RMI supports multiple protocols (JRMP and IIOP). This is a very valid contention. The EJB specification doesn't adequately address multi-vendor interoperability. An organization should standardize on one protocol (we recommend IIOP). For single-vendor installations, the

communication protocol should be completely transparent to both developers and users. The EJB server generates all the communications stubs and proxies at deployment time.

- Microsoft contends that the EJB model will never win universal acceptance since most organizations require support for other languages in addition to Java. The current market dynamics tend to refute this argument—EJB is attracting a lot of customers—but we agree that Java is not the answer for all application systems. The CORBA Components model should address multi-language requirements in the future.
- Microsoft contends that the EJB specification leaves too many important details as an exercise for the vendors. Each vendor is forced to implement proprietary services and extensions to build a complete application server. The proprietary extensions will undermine the portability promise of EJB. The specification is especially vague when describing object activation and deactivation, entity beans, automatic persistence, and security. Many of these issues will be addressed in the next three revisions of the specification over the next two years, but the looseness of the current specification still causes some concern. We find it interesting that Microsoft specifically cites administration tools as a potential point of model fracture. We feel that the administration tools offer an excellent opportunity for product differentiation that has little impact on the purity of the portability model. EJB components are deployed using a JAR file. As long as the component is in a JAR file, it should be deployable to any EJB-compatible application server. It doesn't really matter how the EJB server deploys and administers the components, as long as the components behave in accordance with the EJB specification.

The Bottom Line

MTS and EJB are very similar. Both MTS and EJB support attribute-based computing and a runtime service

framework based on method interception. Both systems automate a number of complex middleware services such as thread management, concurrency control, state management, transactions, and security.

Primary Differences. The most obvious differences between the models are related to platform and language support. MTS supports many different programming languages, but it is only available from one vendor, and it only runs on NT. EJB is available from a variety of vendors, it runs on any platform, but applications can only be developed in Java.

Different Goals. There are a number of other differences between the models, which can be attributed to a different set of design goals. Microsoft's primary goal for MTS is to make multi-tier application development as simple as possible; therefore MTS does not offer as many developer options. MTS supports only one type of component: a stateless server. MTS doesn't allow the developer to override the automatic transaction service. MTS is tightly integrated with other NT services to offer a comprehensive, one-stop-shopping experience. The authors of EJB certainly wanted to deliver ease-of-use, but they had two additional goals, too. EJB is designed to support vendor-neutral application portability. And EJB is designed to support mission-critical, sophisticated application systems. EJB is based on object-oriented principles, therefore it supports more sophisticated state management than MTS. EJB allows developers to bypass the automatic transaction services provided by the EJB container and code transaction control statements directly in the enterprise beans. Since many existing applications were developed with embedded transaction demarcation code, it's easier to port existing applications to EJB than it is to MTS.

MTS or EJB?

If you intend to develop applications for the Windows platforms, and if you feel quite confident that you will never need to port them to any other platforms, then it makes sense to use MTS. MTS is very tightly integrated with the Windows environment, and MTS is included with the NT Server installation kit. If you use NT and you want to develop your server components in a language other than Java, then you probably want to use MTS. But if Java suits your plans and you intend to build applications that might need to run on a variety of platforms, then EJB is a much better alternative.

7.0 Sample of companies and projects using EJBs

Company	1998 Revenue (in millions)	Industry	Project
<u>Bank of America (BankAmerica Corporation) (NYSE: BAC)</u>	\$38,588.0	Banking	The EAGLS (Ernst & Young) project combines the globally accepted commercial card infrastructure with state-of-the-art Internet technology to provide an end-to-end corporate spending management solution. The solution utilizes a three-tiered, thin client architecture integrated with third party Internet enabled applications. The application layer is written in Java, and has been architected around Oracle and Netscape Application Server to scale to handle the massive user load requirements (1.6+ million users).
<u>Home Depot Inc. (NYSE: HD)</u>	\$30,219.0	Retail	The Special Order Center (S.O.C.) division, located in Southfield, Michigan, is seeking an experienced Java Developer to join a team of dedicated I.T. professionals. You must have experience with component architectures, Enterprise Java Beans, distribution and integration mechanisms such as COBRA and application architecture design. The Home Depot S.O.C. is on the leading edge with Enterprise Client-Server, Data Warehousing, Java based Electronic Commerce, large-scale Database Management, Image and Integrated Telephony applications. A wide variety of platforms exist in our environment such as: UNIX, NT, C/C++, DB2, VB, Java and COBOL.
<u>Chase Manhattan Corp.</u>	\$18,656.0	Banking	The position is for the FX Internet project sponsored by GTD. This position is funded by the \$2.5 mm PIF signed by Don Wilson. This individual will be maintaining and enhancing the GTD-FX Internet Web site. This project is central to the division's E-Commerce strategy.
<u>Oracle Corporation (NASDAQ: ORCL)</u>	\$7,143.9	Software Dev. (ISV)	many Java-based projects...

<u>Avnet, Inc. (NYSE:AVT)</u>	\$5,916.3	eCommerce	Responsibilities include development of custom web-based applications using both proven and emerging technologies with room for experimentation and innovation. Requirements include a Bachelor's degree in a computer-related field or equivalent experience. Successful candidate will have proven experience developing web-based applications using some of the following technologies: HTML, Forms, Perl, CGI, XML, JavaScript, server-side Java and database integration (SQL/ODBC/JDBC). Experience Developing Java Servlets with Enterprise Java Beans and Corba/JRMI a plus!
<u>Charles Schwab & Co.</u>	\$2,736.0	Finance	Schwab is now using Java both for internal and Web site development. The brokerage is also working with IBM to get EJB working on its mainframe transaction systems, and the results have been encouraging, she said. Besides moving between operating systems, she wants portability between application servers "so we won't be dead-ended into relying on any particular product." EJB and the array of server APIs Sun and its partners have developed over the past couple of years are also being grouped into a suite called Java 2 Enterprise Edition (J2EE).
<u>Hilton Hotels Corp.</u>	\$1,769.0		Hilton Hotels Corp., for example, took a prebuilt security component from Vision Software Tools Inc. and enhanced it for its needs. The result is a reusable component that becomes part of almost all of the hotel chain's apps. "We put a lot of rules into the component, which govern who gets access to what, what someone sees on a menu tree, and what someone can update or delete," says Brad Hilton, manager of systems development at the hotel chain.
<u>CDI Corp. (NYSE: CDI)</u>	\$1,540.5	Staffing/ Outsourcing	Full life-cycle application framework project in Bethesda, MD.
<u>MasterCard International, Inc.</u>	\$1,257.4	Finance	Credit-card company MasterCard International Inc. turned to a set of Java horizontal infrastructure components from EC Cubed Inc. to connect customer procurement systems with its commercial payment system. The application, which combines line-item details and other purchase information "will allow us to maintain leadership in E-commerce," says Steve Abrams, senior VP of global corporate products. Commercial customers will be able to run reports, perform reconciliation, and match line-item details against purchase orders
<u>Capital One Financial Corporation (NYSE: COF)</u>	\$1,111.5	Banking	Involves the conversion of multiple corporate financial services systems from a mainframe environment to a distributed server environment.

<u>Data Processing Resources Corp. (NASDAQ: DPRC)</u>	\$210.6	Staffing/ Outsourcing	
<u>AnswerThink Consulting Group (NASDAQ: ANSR)</u>	\$102.7	Other	
<u>TransTech, Inc.</u>	\$25.0	Consulting/ Solutions	
<u>CyberGuard Corp. (CYBG)</u>	\$15.6	Software Dev. (ISV)	The individual will design and develop the user interface for the SOHO and next-generation firewall product.
<u>Portal Software, Inc.</u>	\$9.4	Software Dev. (ISV)	Portal develops, markets and supports real-time, scalable customer management and billing software, or CM&B software, for providers of Internet-based services. Portal's Infranet® software is a comprehensive solution that meets the complex, mission-critical provisioning, accounting, reporting and marketing needs of providers of Internet-based services.
<u>BALR Corp.</u>		eCommerce	Specializes in E-commerce apps for business clients. For his latest E-commerce project, [Matthew] Ferris used Kawa to build a series of servlets, which are pieces of application logic written in Java and run on the application server--the Java Web Server from Sun in this case.
<u>Bronner Slosberg Humphrey Inc.</u>		Advertising/M arketing	O'Shea uses Java primarily for its cross-platform capabilities. He is building small, internal applications--one for budgeting and another for staffing analysis. The applications consist of 20 to 30 forms each and execute on a mix of PC and Mac clients.
<u>Ernst & Young LLP</u>		Consulting/ Solutions	Moderated an E-Commerce panel represented by Intel, Cisco, and Ariba
<u>Ernst & Young LLP</u>		Consulting/ Solutions	Chell presented "Selecting Java as a Strategic Development Platform" at 88 Java Bus. Expo

Forté Software Inc.

Software
Dev. (ISV)

Object-oriented enterprise fourth-generation language vendor. "Forté Software, Inc. develops and markets the industry's leading family of application integration and development products for enterprise computing. Forté products greatly simplify the creation and delivery of scalable production systems for Internet environments. Unlike traditional integration tools with weak development capabilities, and unlike traditional development tools with weak integration capabilities, Forté provides a state-of-the-art integration suite along with a new Java development suite. Because they are based on standards, these product families can be used in conjunction with each other or separately with third-party products." Senior Internet Programmer Analyst (IT)

Fortis Health

Insurance

GTE Corporation

Communicati
on
Technology

Clients Wireless' IT projects.

These projects cover the areas of electronic commerce, customer care, help-desk, data warehousing, ordering, billing, switch management and activation, phone equipment fulfillment and supply chain integration. Houston custom development shop that builds Java applications for the oil and gas industry.

Interactive Technologies Inc.

Other

netWorkMasters, Inc.

Communicati
on
Technology

Application for a state project, which is being built with Java and XML using Servlets and taking advantage of Enterprise Java beans. The J-business Applications Server and Get Access Security Package complete the technologies being used in development. This application pulls data from an Oracle Database.

New York Life Insurance
Company

Insurance

Perspective Technology Corp.

Consulting/
Solutions

Using EJB technology to build a Web customer self-service application for a client.

PharmaCentric Technologies

Software
Dev. (ISV)

As part of a project team, you will develop mission-critical software for PharmaCentric's line of web-based enterprise business solutions. This position involves web-related software development including Java GUIs, server-side Java, Enterprise Java Beans, JDBC, and tools such as application servers and relational databases. Multiple positions available, all levels. Moscovitz presented a case study on their Ernst & Young developed web-based information product. E&Y delivered to S&P "RatingsDirect" in 1988. "RatingsDirect will for the first time combine all of their information across all business units, delivered in real time."

Thoughtworks LLC

Consulting/
Solutions

Custom development shop

Tribune Co.

Communicati
on
Technology

[Jeff] Gear built a complex Java application that lets workers control broadcast TV equipment remotely. Tribune operates 17 TV stations in addition to newspapers and a book publisher. The application makes extensive use of Java servlets, but also used Corba for communications between a diverse set of client and server objects.

Volt Information Sciences, Inc.

Communicati
on
Technology

These chosen candidates will manage software repository, develop business logic in JAVA, VB/ASP (Active System Page), C++, MS EC Packages, in particular SiteServer, e-Commerce framework, Microsoft Transaction Server and Microsoft Message Queue. These together with IBM EC Packages - WebSphere, Component Broker, Netscape/Sun EC Packages - NetDynamics Application Server, CommerceXpert, SuiteSpot and COBRA/Enterprise Java Beans is essential. Also proficiencies in Siebel using technical background to include, VB, Siebel Tools, SQL and Com, and Metasolve, notably experience with the Metasolve application and a working knowledge of the operations support systems.

Warburg Dillon Read

Banking

Design and implement reporting solutions for a global trade warehouse project, using distributed Java and web technology.

Beatnik, Inc.

Software
Dev. (ISV)

Responsible for creating design documents and implementing java, java beans, and C++ for server-side database and stand-alone applications. Beatnik, Inc. is a start-up company with a mission to bring sound and music to the digital world. We are building an e-commerce website to license production music, sound, and software online. Specifying, designing, developing and supporting database applications, stored procedures and triggers to support complex for Oracle 8 or Oracle 8i, WebLogic, and Remedy applications environments

Computer Horizons Corp.

na Banking This project is for a huge Bank in their retail delivery area. We are automating business processes that will be used by the Retail Banking Centers and Call Centers for the customer service function.

EC Cubed, Inc.

na Credit-card company MasterCard International Inc. turned to a set of Java horizontal infrastructure components from EC Cubed Inc. to connect customer procurement systems with its commercial payment system. The application, which combines line-item details and other purchase information "will allow us to maintain leadership in E-commerce," says Steve Abrams, senior VP of global corporate products. Commercial customers will be able to run reports, perform reconciliation, and match line-item details against purchase orders

Front Ends Inc.

na Consulting / Solutions "I went through some pain in the early days, and now I can't understand why everyone isn't using it," said Andrew Roberts, a vice president at software developer Front Ends Inc., which took delivery of San Francisco version 1.0 in the fall of 1997. Using San Francisco, now in its fourth release, Front Ends has built a pilot application for Planned Parenthood Southeast Texas that connects patient records at 10 clinics with Planned Parenthood's network of 900 clinics nationwide.

Global Logistics Technologies, Inc.

na Software Dev. (ISV) "Very conservatively, 70 percent of this application is being handled by San Francisco," said Roberts, who is planning to reuse much of the application for a European network of kidney dialysis clinics. G-Log product

Homebid.com

na eCommerce

AT A GLANCE: Homebid.com
Business: Real-estate auctions
Projected launch: October 1999 Technology: Oracle8i database on Sun Solaris, Apache Web server, Dynamo Applications Server, JavaScript, C++, Enterprise JavaBeans
Outsourcer: Scient Corp.
Cost: \$2.5 million

i-mind education systems inc.

na Software Dev. (ISV)
i-mind's mission is to provide a user-friendly but state-of-the-art computer-based K-12 learning environment that can be accessed anywhere, anytime to promote student performance, teacher productivity and communication between student, teachers and parents.

Internet Shopping Network

na
The Internet Shopping Network in Sunnyvale, Calif., a subsidiary of USA Networks, turned to one of the new generation of Enterprise JavaBean components to build a sophisticated order-management system to handle orders from its auction and conventional retail sites. The components, from Theory Center Inc., connect the company's database, legacy systems, and Web storefronts. Short term contract (about 4 mos.) for large telecommunications company. This is an Order Management system being built in Java. The back end is Oracle but it is not required. This is server side work. Will be integrating a work flow product into the development of this order management system.

Object Systems Group, Inc.

na Communication Technology
na Software Dev. (ISV)
na Consulting/Solutions

Major Financial Firm in Stamford CT is looking for P/A to design and implement reporting solutions for a global trade warehouse project, using distributed Java and Web technology. The project currently uses Java, CORBA(Visigenics), SQR, Perl CGI, HTML, Oracle Express and Sybase on a UNIX(Solaris)platforms. The strategic direction for the project is to move to a Java Servlet and EJB based intranet portal architecture incorporating user published web content from Oracle Express, Business Objects and Lotus Domino. Completely New Development. Java, Servlets (the most important skill here), Enterprise Java Beans (EJB), Unix and or NT, UML.

Peridyne Technology Solutions

na Consulting/Solutions
na Consulting/Solutions

RHI Consulting

SPL WorldGroup Consulting

na Consulting/Solutions

Valtech

na Other

This position will involve designing and developing 3-tier applications using EJB for middle-tier integrated applications servers

Vision Software Tools, Inc.

na

Hilton Hotels Corp., for example, took a prebuilt security component from Vision Software Tools Inc. and enhanced it for its needs. The result is a reusable component that becomes part of almost all of the hotel chain's apps. "We put a lot of rules into the component, which govern who gets access to what, what someone sees on a menu tree, and what someone can update or delete," says Brad Hilton, manager of systems development at the hotel chain.

Company Sector City State Phone Project Contact Notes & References

Bronner Slosberg Humphrey Inc. Boston MA 617-867-1000

O'Shea uses Java primarily for its cross-platform capabilities. He is building small, internal applications--one for budgeting and another for staffing analysis. The applications consist of 20 to 30 forms each and execute on a mix of PC and Mac clients.

Ref. "Java Made Simple" application developer (quoted in "Java Made Simple" article)

InformationWeek article

Bank of America Banking

E&Y Java Success Stories web page

The EAGLS (Ernst & Young) project combines the globally accepted commercial card infrastructure with state-of-the-art Internet technology to provide an end-to-end corporate spending management solution. The solution utilizes a three-tiered, thin client architecture integrated with third party Internet enabled applications. The application layer is written in Java, and has been architected around Oracle and Netscape Application Server to scale to handle the massive user load requirements (1.6+ million users).

Capital One Financial Corporation Falls Church VA 703-205-1000

Looking to hire 300 people to their "IT shop" this year. (according to Consults)

Chase Manhattan Corp. Banking Brooklyn NY (212) 270-6000

Involves the conversion of multiple corporate financial services systems from a mainframe environment to a distributed server environment.

The position is for the FX Internet project sponsored by GTD. This position is funded by the \$2.5 mm PIF signed by Don Wilson. This individual will be maintaining and enhancing the GTD-FX Internet Web site. This project is central to the division's E-Commerce strategy.

Story: "CHASE AND SHOPNOW.COM TO LAUNCH INTERNET SHOPPING SITE"

This project is for a huge Bank in their retail delivery area. We are automating business processes that will be used by the Retail Banking Centers and Call Centers for the customer service function.

Design and implement reporting solutions for a global trade warehouse project, using distributed Java and web technology.

Clients Wireless' IT projects.

These projects cover the areas of electronic commerce, customer care, help-desk,

data warehousing, ordering, billing, switch management and activation, phone

equipment fulfillment and supply chain integration.

Application for a state project, which is being built with Java and XML using Servlets and taking advantage of

Enterprise Java beans. The J-business Applications Server and Get Access

Security Package complete the technologies being used in

development. This application pulls data from an Oracle Database.

Short term contract (about 4 mos.) for large telecommunications company. This is an Order Management system being built in Java. The back end is Oracle but it is not required. This is server side work. Will be integrating a work flow product into the development of this order management system.

<u>Computer Horizons Corp.</u>	Banking	Columbus	OH	
<u>Warburg Dillon Read</u>	Banking	Stamford	CT	203-719-1000
<u>GTE Corporation</u>	Communication Technology	Atlanta	GA	813-978-4578
<u>netWorkMasters, Inc.</u>	Communication Technology	Boston	MA	978-264-0012

<u>Object Systems Group, Inc.</u>	Communication Technology
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<u>Sprint Communications Co.</u>	Westwood	KS	(913) 624-3000
<u>Tribune Co.</u>	Communication Technology	Chicago	IL 312-222-9100

[Jeff] Gear built a complex Java application that lets worker's control broadcast TV equipment remotely. Tribune operates 17 TV stations in addition to newspapers and a book publisher. The application makes extensive use of Java servlets, but also used Corba for communications between a diverse set of client and

Jeff Gear, development manager at the Tribune Co.'s advanced technology group (quoted in "Java Made Simple" article)
Ref: "Java Made Simple" [InformationWeek article](#)

server objects.

Volt Information Sciences, Inc. Communication Technology New York NY 212-719-7800

These chosen candidates will manage software repository, develop business logic in JAVA, VB/ASP (Active System Page), C++, MS EC Packages, in particular SiteServer: e-Commerce framework, Microsoft Transaction Server and Microsoft Message Queue. These together with IBM EC Packages - WebSphere, Component Broker, Netscape/Sun EC Packages - NetDynamics Application Server, CommerceXpert, SuiteSpot and COBRA/Enterprise Java Beans is essential. Also proficiencies in Siebel, using technical background to include, VB, Siebel Tools, SQL and Com. and Metasolve, notably experience with the Metasolve applicatio., and a working knowledge of the operations support systems.

Ernst & Young LLP Consulting/ Solutions Sacramento CA Colette Coad: 914-449-3513

Moderated an E-Commerce panel represented by Intel, Cisco, and Arba

Colette Coad, partner (colette.coad@ey.com)

E&Y's Java "Contact Us" web page

Ernst & Young LLP Consulting/ Solutions Sacramento CA 3513

Chell presented "Selecting Java as a Strategic Development Platform" at 98 Java Bus. Expo

Chell Smith, director of E&Y's Advanced Development Centers

1998 Java Business Expo (December 8 - 10 at the Jacob K. Javits Convention Center in New York City)

Perdyne Technology Solutions Consulting/ Solutions Atlanta GA 404-995-1770

Completely New Development. Java, Servlets (the most important skill here), Enterprise Java Beans (EJB), Unix and or NT, UML.

Perspective Technology Corp. Vienna VA (703) 821-8800

Using EJB technology to build a Web customer self-service application for a client.

Ref: "Java Made Simple" InformationWeek article

RHI Consulting Consulting/ Solutions Pittsburgh PA (412) 471-0888

Max Messmer, CEO

SPL WorldGroup Consulting Consulting/ Solutions Chicago IL 773-380-3016

Thoughtworks LLC Consulting/ Solutions San Bruno CA 650-742-7795

Custom development shop

Adam Abrons (quoted in "Java Made Simple" article) Ref: "Java Made Simple" InformationWeek article

312.648.4615

Mohnish Pabrai, Founder, President & CEO

TransTech, Inc. Consulting/ Downers IL 800-676-7374 x236
Solutions Grove 630-493-9900 x236

Gerald W. Pottebaum,
Executive Vice President

TransTech, Inc. Consulting/ Downers IL 630-493-9900 x225
Solutions Grove

Responsibilities include development of custom web-based applications using both proven and emerging technologies with room for experimentation and innovation. Requirements include a Bachelor's degree in a computer-related field or equivalent experience. Successful candidate will have proven experience developing web-based applications using some of the following technologies: HTML Forms, Perl, CGI, XML, JavaScript, server-side Java and database integration (SQL/ODBC/JDBC). Experience developing Java Servlets with Enterprise Java Beans and Corba/JRMI a plus!

Avnet, Inc. eCommerce Lexington KY 606-259-1967

Matthew Ferris, a
consultant at BALR Corp. Ref: "Java Made Simple"
(quoted in "Java Made InformationWeek article
Simple" article)

BALR Corp. eCommerce Oakbrook IL 630.575.8200

Specializes in E-commerce apps for business clients. For his latest E-commerce project, [Matthew] Ferris used Kawa to build a series of servlets, which are pieces of application logic written in Java and run on the application server--the Java Web Server from Sun in this case.

Chris Muir, VP of
Technology; Denise
Daniels VP E-Commerce

Beatnik, Inc. creates
technologies for the delivery
of music and sound over
the Internet. The compar
was established in 1993 by
musician/composer Thomas
Dolby Robertson and
multimedia entrepreneur
Mary Collier

Beatnik, Inc. eCommerce San Mateo CA 650-295-2300

Responsible for creating design documents and implementing java, java beans, and C++ for server-side database and stand-alone applications. Beatnik, Inc. is a start-up company with a mission to bring sound and music to the digital world. We are building an e-commerce website to license production music, sound, and software online. Specifying, designing, developing and supporting database applications, stored procedures and triggers to support complex for Oracle 8 or Oracle 8i, WebLogic, and Remedy applications environments

No job postings, but link to article about NYLIC winning "Java Cup Award"

Fortis Health Insurance Milwaukee WI 414-271-3011
New York Life Insurance Company New York NY 212-576-7000

Orion Insurance Boston MA 617-310-5060

Major Financial Firm in Stamford CT is looking for P/A to design and implement reporting solutions for a global trade warehouse project, using distributed Java and Web technology. The project currently uses Java, CORBA(Visigenics), SQL, Perl CGI, HTML, Oracle Express and Sybase on a UNIX(Solaris)platforms. The strategic direction for the project is to move to a Java Servlet and EJB based intranet portal architecture incorporating user published web content from Oracle Express, Business Objects and Lotus Domino.

AnswerThink Consulting Group Other Miami FL 305-375-8005

Ted A. Fernandez, CEO of AnswerThink; Joe Dugan, managing director of AnswerThink Consulting Group

Interactive Technologies Inc. Houston TX 713-975-7434

Houston custom development shop that builds Java applications for the oil and gas industry.

Ref: "Java Made Simple" InformationWeek article

Valtech Other Dallas TX 1-800-249-0123

This position will involve designing and developing 3-tier applications using EJB for middle-tier integrated applications servers

In February of this year Valtech acquired Expede, a Dallas-based advanced technology consulting group.

Home Depot Inc. Retail Detroit MI 770-433-8211

The Special Order Center (S.O.C.) division, located in Southfield, Michigan, is seeking an experienced Java Developer to join a team of dedicated I.T. professionals. You must have experience with component architectures, Enterprise Java Beans, distribution and integration mechanisms such as COBRA and application architecture design. The Home Depot S.O.C. is on the leading edge with Enterprise Client-Server, Data

Steve Kaip, Vice President Information System
The Home Depot
Special Order Center
400 Galleria Offcentre, Suite #400
Southfield, MI 48034
Fax: (248) 204-3681

Ron Griffin, CIO (Novera customer)

Warehousing, Java based Electronic Commerce, large-scale Database Management, Image and Integrated Telephony applications. A wide variety of platforms exist in our environment such as: UNIX, NT, C/C++, DB2, VB, Java and COBOL.

CyberGuard Corp. Software Dev. (ISV) Fort Lauderdale FL 954-958-3900 The individual will design and develop the user interface for the SOHO and next-generation firewall product.

Michael Wittig
Vice President of
Worldwide Development
and Chief Technical
Officer

Cyberguard Corporation, headquartered in Fort Lauderdale, Florida has been developing leading-edge commercial network security products designed to protect data on computer networks from unauthorized access since 1987. Formerly the Trusted Systems Division of Harris Computer Systems Corporation, in June 1996 the Company changed its name to CyberGuard - the name of its flagship firewall product - to better reflect new focus on Internet and intranet security solutions.

Forté Software Software Oakland CA (510) 869-
Inc. Dev. (ISV) 3400

Object-oriented enterprise fourth-generation language vendor. "Forté Software, Inc. develops and markets the industry's leading family of application integration and development products for enterprise computing. Forté products greatly simplify the creation and delivery of scalable production systems for Internet environments. Unlike traditional integration tools with weak development capabilities, and unlike traditional development tools with weak integration capabilities, Forté provides a state-of-the-art integration suite along with a new Java development suite. Because they are based on standards, these product families can be used in conjunction with each other or separately with third-party products."

Ref: "Java Made Simple"
InformationWeek article

Global Logistics Technologies, Inc. Shelton CT 203-225-0335

James P. Mooney, CTO

Software solution for

i-mind education systems inc. Corte CA 415-927-8668

Transportation/Logistics
i-mind's mission is to provide a user-friendly but state-of-the-art computer-based K-12 learning environment that can be accessed anywhere, anytime to promote student performance, teacher productivity and communication between student, teachers and parents.

ObjectSpace, Inc Software Dallas TX 1-800-OBJECT-1

Overview

Oracle Corporation Dev. (ISV) Redwoo CA 650-506-7000

many Java-based projects...

PharmaCentric Technologies RTP NC 919-806-2323

Michael Hillerbrand, CEO
Glenn Clingroth,
Development Team
Leader

As part of a project team, you will develop mission-critical software for PharmaCentric's line of web-based enterprise business solutions. This position involves web-related software development including Java GUIs, server-side Java, Enterprise Java Beans, JDBC, and tools such as application servers and relational
pages
Surprisingly, no explicit references to EJB in hiring
TrialTrack is a clinical trial management system built on proven Oracle(tm) database and BEA WebLogic component technologies that puts critical, real-time trial information in the hands of every CRO, SMO, or

databases. Multiple positions available, all levels.

TestMyBeans.com
Business Plan
Revision 2.0
sponsor PC.

Portal Software, Inc. Software Dev. (ISV) Cupertino CA (408) 343-4400

Portal develops, markets and supports real-time, scalable customer Jobs advertised in "Java management and billing software, or CM&B software, for providers Developers Journal"; a of Internet-based services. Portal's Infranet® software is a couple of ex-Sybase guys comprehensive solution that meets the complex, mission-critical in management team (Jack provisioning, accounting, reporting and marketing needs of Acosta and Mike Regan) providers of Internet-based services.

CDI Corp. Staffing/ Outsourcing Philadelphia PA 215-569-2200

Full life-cycle application framework project in Bethesda, MD.

Data Processing Resources Corp. Staffing/ Outsourcing Irvine CA 949-553-1102

Mary Ellen Weaver, CEO A lot of EJB hits on Monster.com...
Ken Moscovitz, CIO of Standard and Poor's 1998 Java Business Expo (December 8 - 10 at the Jacob K. Javits Convention Center in New York City)

Moscovitz presented a case study on their Ernst & Young developed web-based information product. E&Y delivered to S&P "RatingsDirect" in 1988. "RatingsDirect will for the first time combine all of their information across all business units, delivered in real time."

8.0 Appendix

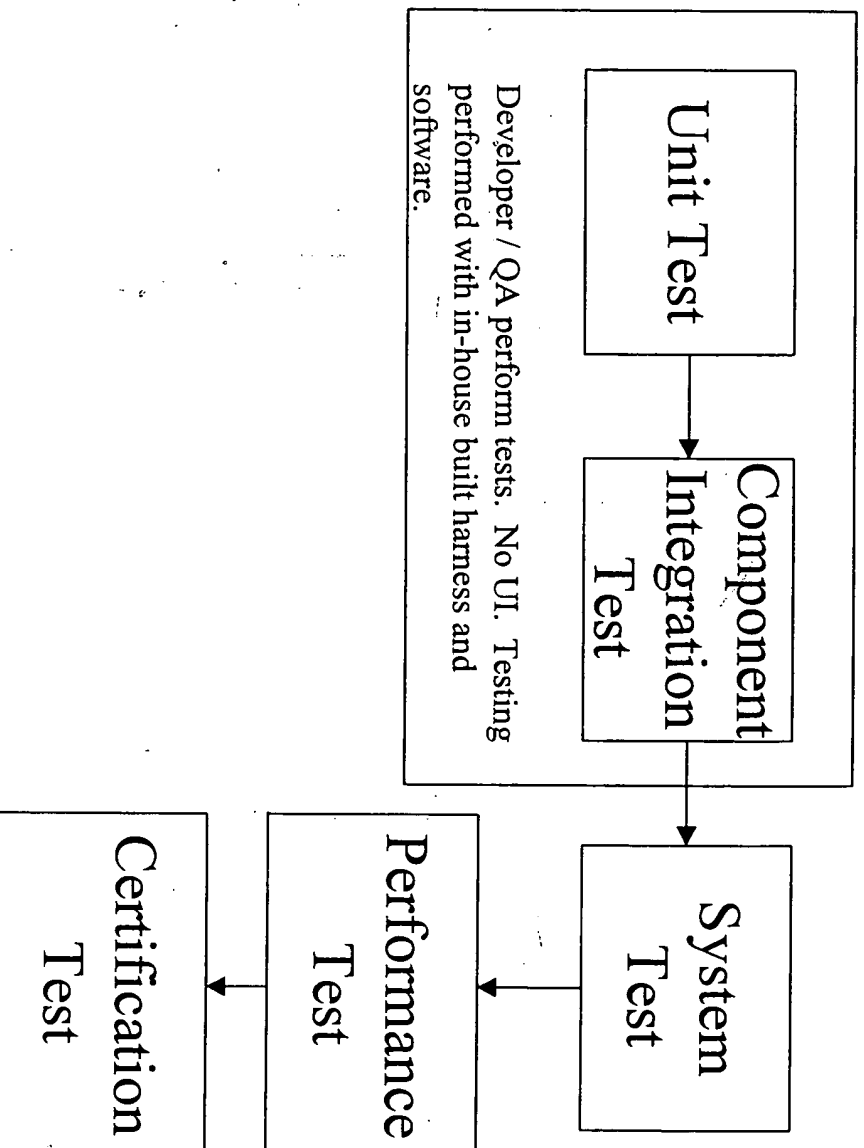
8.1 Worldwide programming licenses

	WW Seats	WW Seats	WW Seats	WW Seats	WW Seats	WW Seats	WW Seats	CAGR
Language	1997	1998 F	1999 F	2000 F	2001 F	2002 F	2003 F	98-03
COBOL	1,543,446	1,600,743	1,643,069	1,661,535	1,620,245	1,520,327	1,386,750	-2.8%
C++/C	2,407,322	2,861,174	3,269,208	3,638,461	4,016,552	4,368,208	4,786,985	10.8%
Other 3GL	908,733	937,389	941,246	927,386	866,194	788,102	695,275	-5.8%
Java	275,370	705,752	1,162,202	1,714,229	2,382,665	3,075,869	4,043,300	41.8%
Smalltalk	56,671	53,233	48,261	42,098	29,444	14,862	5,792	-35.8%
Visual Basic	4,658,252	5,773,681	6,391,038	6,692,463	6,913,486	7,005,175	6,863,210	3.5%
4GL RAD	729,524	728,588	747,269	720,388	705,244	672,573	630,167	-2.9%
4GL	781,551	721,722	605,839	445,114	248,959	99,070	12,774	-55.4%
3GL RAD	802,497	792,795	771,836	693,897	575,090	396,898	242,434	-21.1%
Other Languages	816,454	786,340	757,362	701,766	641,707	558,969	456,228	-10.3%
Internet RAD	103,188	200,578	343,954	512,782	661,060	805,185	948,138	36.4%
CBD	59,815	117,427	204,203	350,264	565,301	989,886	1,450,004	65.3%
HTML	1,072,172	1,931,503	2,865,040	3,916,448	4,678,849	4,903,425	5,248,419	22.1%
Total Pgmr Seats	14,214,995	17,210,925	19,750,527	22,016,829	23,904,797	25,198,550	26,769,477	9.2%
Total Pgmr Seats	17.6%	21.1%	14.8%	11.5%	8.6%	5.4%	6.2%	

8.2 TestMyBeans revenue and market share projections 1999 - 2002

	1998	1999	2000	2001	2002
Number of EJB Seats	26,656	88,973	328,184	713,659	1,033,921
EJB Test TAM	\$ 1,066,260	\$ 3,558,912	\$ 13,127,363	\$ 32,114,676	\$ 46,526,441
TestMyBeans.com Revenue	\$ 0	\$ 80,000	\$ 3,500,000	\$ 15,000,000	\$ 25,000,000
EJB Test Share	0%	2%	27%	47%	54%
Software Test Share	0%	0%	0.6%	1.8%	2.0%
Total Software Test Market from 1/99 Schedule 1	\$ 286,000,000	\$ 409,000,000	\$ 584,870,000	\$ 848,061,500	\$ 1,229,689,175

8.3 USAA test process



8.4 Competitive P&L Models

Mercury Interactive

Revenue

Sales	\$	121,000
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Cost of revenue

license	\$	6,291	5%
service	\$	11,757	10%
Total cost of revenue	\$	18,048	15%

Gross profit	\$	102,952	85%
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Operating expenses

R&D net	\$	15,747	13%
Marketing and Selling	\$	56,476	47%
G&A	\$	8,052	7%
Total operating expenses	\$	80,275	66%

PBIT from operations	\$	22,677	19%
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Segue

Segue P&L 1998

Revenue

Sales	\$	41,959
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Cost of revenue

license	\$	3,039	7%
service	\$	6,119	15%
Total cost of revenue	\$	9,158	22%

Gross profit	\$	32,801	78%
--------------	----	--------	-----

Operating expenses

R&D net	\$	8,571	20%
Marketing and Selling	\$	20,892	50%
G&A	\$	4,410	11%
Total operating expenses	\$	33,873	81%

PBIT from operations	\$	(1,072)	-3%
----------------------	----	---------	-----